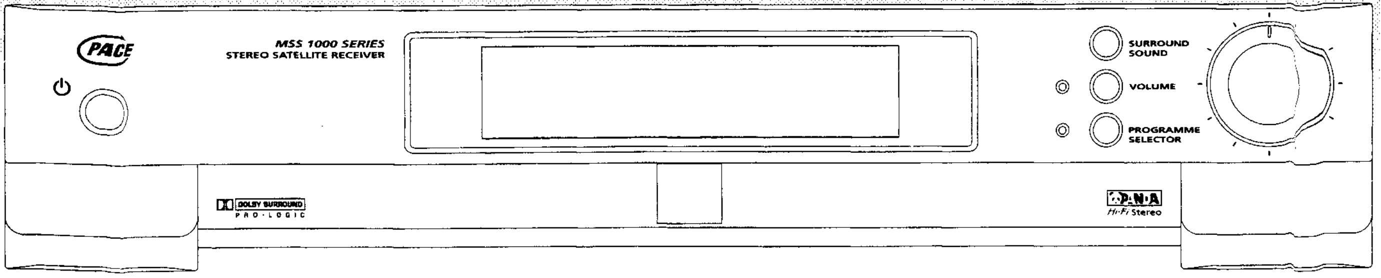
Service Manual

MSS 1001-I
MSS 1008-IP
MSS 1038-G
MSS 1038-GP
MSS 508-IP
MSS 538-GP
MSS 534-G


PACE
MSS 1000 SERIES
STEREO SATELLITE RECEIVER
SURROUND SOUND
VOLUME
PROGRAMME SELECTOR
DOLBY SURROUND
PRO·LOGIC
Hi-Fi Stereo

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IMPORTANT - THIS MANUAL COVERS THE MSS1001-I, MSS1008-IP, MSS1038-G, MSS1038-GP, MSS508-IP and MSS538-GP RECEIVERS.

The differences between the MSS1001-I and the other receivers are summarised below.

Model	Video Crypt	Sound PCB	Front Panel Display PCB	2-Card Reader PCB	Positioner PCB
MSS1001-I	✓	✓	✓	✓	
MSS1008-GP	✓	✓	✓	✓	✓
MSS1038-G		✓	✓		
MSS1038-GP		✓	✓		✓
MSS508-IP	✓		✓	✓	✓
MSS538-GP			✓		✓

NOTE 1: STATUS OF THE PRODUCT

The MSS1001-I contains four PCBs (some units also have a small microprocessor extension PCB). The four PCBs described in this manual are at the following revisions: Main Board Revision B2A, Sound Board Revision A4, Card Reader Board Revision B3 and Display Board Revision A4. Each PCB's part number is marked on the component side of the PCB. This number can be read on the appropriate component ident diagram in this manual, for example where revision A4 is denoted by the characters 104 at the end of the part number.

The parts lists and circuit diagrams in this manual include information from all Engineering Change Orders (ECOs) up to and including ECO S001395 and all Production Change Orders (PCOs) up to and including PCO S000622, provided that these ECOs and PCOs had an effectivity date on or before 01.11.96. Further changes will be given in technical bulletins until this manual is re-issued.

If you need to find out the software version number of the receiver, it is displayed at the start of the display self test sequence (see page 22).

NOTE 2: CIRCUIT DIAGRAMS

Sheets containing the circuit diagrams of all four PCBs and the positioner board are located in the pocket inside the back cover of this manual.

NOTE 3: VIDEOCRYPT CIRCUIT DESCRIPTION AND DIAGRAMS

For copyright reasons, these have been printed on special paper on a separate sheet, part of which has been overprinted with broad diagonal stripes to prevent photocopying. Each of these sheets has a unique, traceable serial number. As the card reader PCB is intimately linked with the VideoCrypt circuitry, the description of the card reader circuitry is also given on this sheet, which can be found in the pocket at the rear of the manual.

MODEL NUMBERING SYSTEM FOR MSS 1000 AND 500 SERIES RECEIVERS

The first character(s) of the model number dictate the sub-series within the MSS range as follows:

- **10 = MSS 1000 series:**
- **5 = MSS 500 series.**

The MSS 1000 series receivers contain a sound board for home cinema effects (these are not available for the MSS 500 series).

The subsequent characters in the model number have the following meanings:

MSS 10	**X**	**X**	**-**	**X**	**X**
	Decoder	**Tuner**		**System**	**Polariser/Dish Positioner**
		0 = 27 MHz, single LNB		I = PAL I	P = integral
		1 = 27 MHz, dual LNB		G = PAL G	No letter = none
		2 = 18/27 MHz, single LNB		K = PAL K	
		3 = 27/36 MHz, single LNB		L = SECAM L	
		4 = 18/27 MHz, dual LNB		etc.	
		6 = 27/36 MHz, dual LNB			
		7 = 15/27 MHz, single LNB			
		8 = 15/27 MHz, dual LNB			

0 = VideoCrypt (2 card readers, UK programme list, English on-screen graphics)
1 = MAC (2 card readers, Scandinavian programme list and on-screen graphics)
2 = VideoCrypt + MAC (4 card readers, Scandinavian programme list and on-screen graphics)
3 = None (continental Europe programme list and multi-lingual on-screen graphics)
4 = None (Middle East programme list)
5 = Not used
6 = MAC (4 card readers, Scandinavian programme list and on-screen graphics)

Examples:

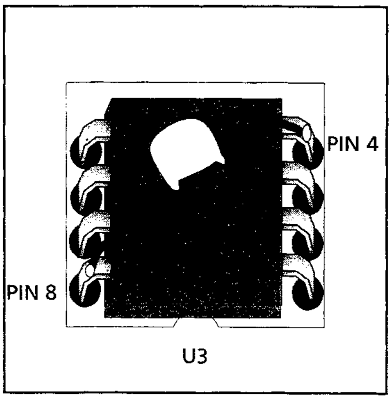
MSS 1001-I = home cinema effects, VideoCrypt decoder, 27 MHz dual LNB tuner, PAL I (standard UK model)
MSS 1038-G = home cinema effects, no decoder, 15/27 MHz dual LNB tuner, PAL G (standard “World” model)
MSS 1038-GP = as above, but with integral positioner
MSS 501-I = VideoCrypt decoder, 27 MHz dual LNB tuner, PAL I (standard UK model)
MSS 538-G = no decoder, 15/27 MHz dual LNB tuner, PAL G (standard “World” model)

ECO 001146: Preventing U3 (LM358) becoming unstable (due to a 500 kHz oscillation being superimposed on the tone), when the 22 kHz tone switching option is set to "On" at the Tuning Menu.

Solution: On the component side of the Main PCB, fit a 220 nF 50 v 2% 5 mm Cer Cap TR (150-2245951) from pin 8 to pin 4 of U3 (LM358). On the surface mount side of the Main PCB, fit a 220 nF 50 v 2% 5 mm Cer Cap TR (150-2245951) from pin 1 to pin 4 of U3 (LM358).

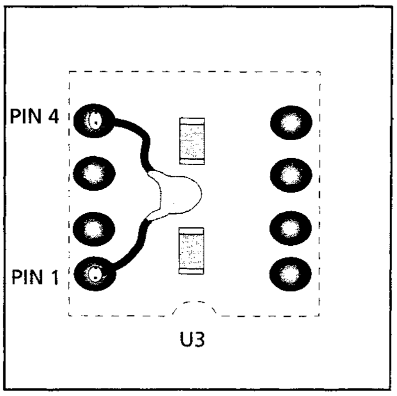
2 OFF 220NF 50V Z% 5MM CER CAP TR (0805)	150-2245951

FIGURE 1


PIN 4
PIN 8
U3

PCB TOPSIDE

FIGURE 2

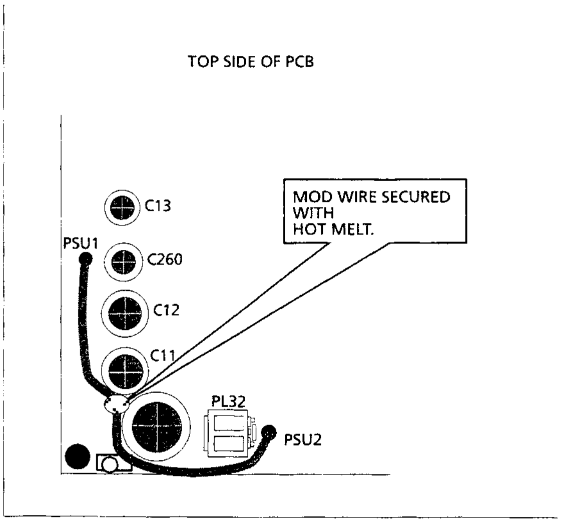

PIN 4
PIN 1
U3

PCB UNDERSIDE

ECO 000765: Securing the mod wire in models with dish positioner PCB or sound PCB.

Solution: On the component side of the Main PCB, secure the mod wire connecting PSU1 and PSU2 with hot melt adhesive (206-1059960).

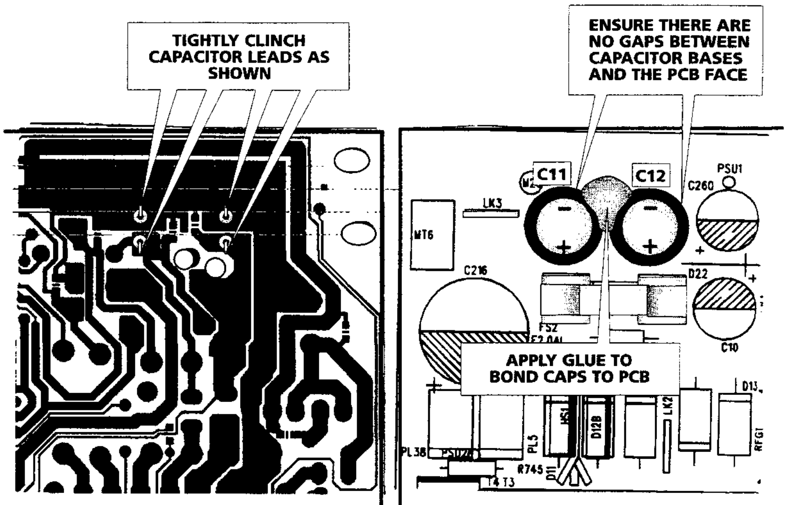
1 OFF HOT MELT ADHESIVE	206-1059960


TOP SIDE OF PCB
C13
PSU1
C260
C12
C11
MOD WIRE SECURED WITH HOT MELT.
PL32
PSU2

ECO 000585: Preventing damage to the circuit (from excessive voltage) caused by the pads and solder joints on C11 and C12 breaking.

Solution: On the surface mount side of the Main PCB, secure capacitor leads against pads. On the component side of the Main PCB, glue the capacitors to the Main PCB with hot melt adhesive (206-1059960), ensuring that there are no gaps between the capacitors and the face of the PCB.

1 OFF HOT MELT ADHESIVE	206-1059960

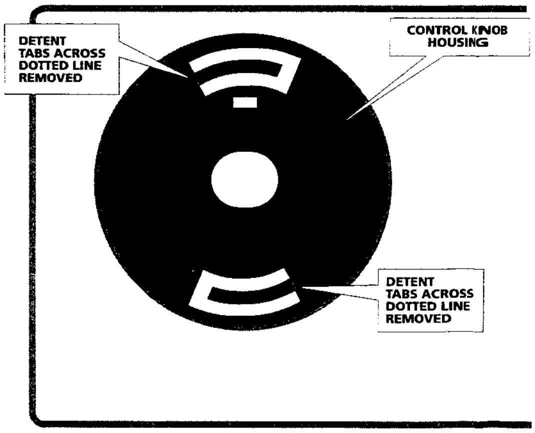

TIGHTLY CLINCH CAPACITOR LEADS AS SHOWN
ENSURE THERE ARE NO GAPS BETWEEN CAPACITOR BASES AND THE PCB FACE
C11
C12
PSU1
C260
LK3
MT6
C216
D22
C10
FS2
APPLY GLUE TO BOND CAPS TO PCB
PL5
D11
D12B
LK2
PL38
R745
T3

UNDERSIDE OF PCB

TOPSIDE OF PCB

ECO 001343: Preventing the receiver randomly coming out of standby or changing channels.

Solution: On the front panel PCB, change the switch to one with an in-built detent (146-0002421) and remove the existing detent tabs from behind the knob on the front panel moulding.

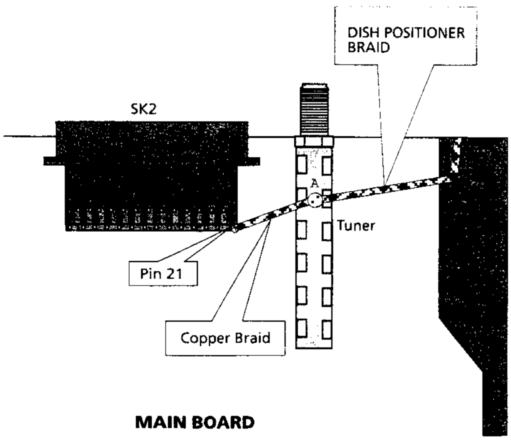

DETENT TABS ACROSS DOTTED LINE REMOVED
CONTROL KNOB HOUSING
DETENT TABS ACROSS DOTTED LINE REMOVED

FRONT PANEL MOULDING
(REAR VIEW)

ECO 001215: Reducing emissions and improving immunity to meet EMC requirements (EN55013 and EN55020).

Solution: On the component side of the Main PCB, fit a 40 mm length of 2mm X 0.5 mm flat copper braid (190-0030020) as shown. When fitting a dish positioner PCB, solder the braid to the Tuner on the Main PCB as shown.

1 OFF 2MMX0.5MM COPPER BRAID	190-0030020

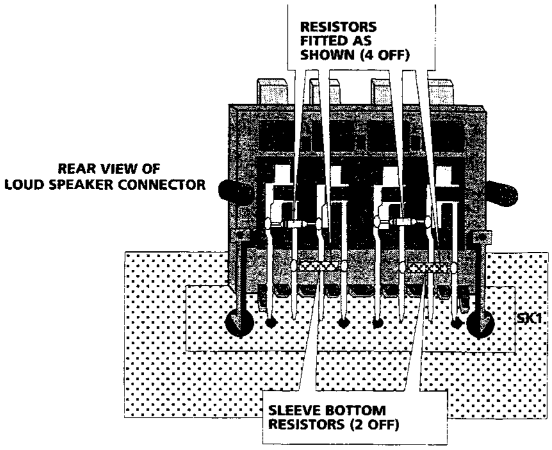

DISH POSITIONER BRAID
SK2
A
Tuner
Pin 21
Copper Braid

MAIN BOARD

ECO 000587: Preventing amplifier damage by providing a discharge path for large value speaker decoupling capacitors on the sound PCB.

Solution: On the component side of the Sound PCB, fit four 680R 0.25 W 5% carbon film resistors (140-6812501) as shown. The bottom two resistors must each be sleeved with an 8 mm length of 2 mm x 10 M black silicone sleeving (203-2100100).

4 OFF	680 0.25W 5% FILM RES	140-6812501
2 OFF	8MMX2MM SILICONE SLEEVING	203-2100100



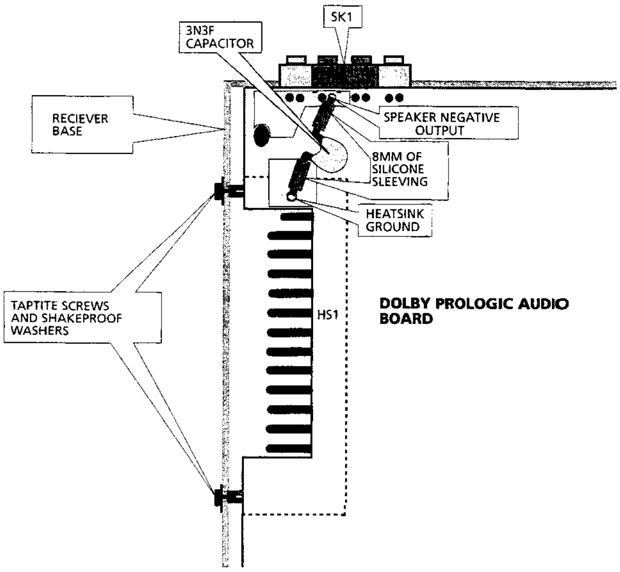
RESISTORS FITTED AS SHOWN (4 OFF)
REAR VIEW OF LOUD SPEAKER CONNECTOR
SK1
SLEEVE BOTTOM RESISTORS (2 OFF)

ECO 001232: Reducing emissions and improving immunity to meet EMC requirements (EN55013 and EN55020) on the sound PCB.

Solution: On the surface mount side of the sound PCB, fit a 3N3F 100 V 10% 5 mm Cer cap TR (150-3327651) from the heat sink ground to the speaker negative output. Fit two 8 mm lengths of 1 mm x 15 M black silicone sleeving (203-1150100) as shown.

Ensure that the heatsink on the sound PCB is secured to the receiver base by two taptite screws M3 x 8 P/P TAP (246-3080011) and two shakeproof washers (241-0031001) as shown.

1 OFF	3N3F 100V 10% 5MM CER CAP TR	150-3327651
2 OFF	8MMX1MM SILICONE SLEEVING	203-1150100
2 OFF	TAPTITE SCREW M3X8P/P TAP	246-3080011
2 OFF	SHAKEPROOFWASHERS	241-0031001

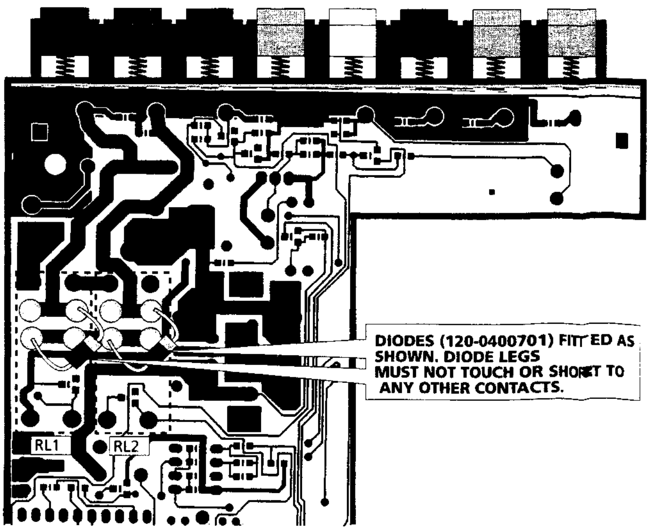


3N3F CAPACITOR
SK1
RECIEVER BASE
SPEAKER NEGATIVE OUTPUT
8MM OF SILICONE SLEEVING
HEATSINK GROUND
TAPTITE SCREWS AND SHAKEPROOF WASHERS
HS1
DOLBY PROLOGIC AUDIO BOARD

ECO 000615: Preventing occasional relay bounce and software malfunction on the positioner PCB.

Solution: On the surface mount side of the positioner PCB, fit two IN4007 diodes (120-0400701) ensuring that the legs are clear of all the PCB tracks and that they are not touching any other contacts as shown.

2 OFF	IN4007 DIODE	120-0400701



DIODES (120-0400701) FITTED AS SHOWN. DIODE LEGS MUST NOT TOUCH OR SHORT TO ANY OTHER CONTACTS.
RL1
RL2

OUTLINE SPECIFICATION

GENERAL

Number of Programmes	500
Front Panel Control	Standby and Surround Sound buttons; buttons to convert dial to volume control or programme selector
UHF Modulator	CCIR PAL System I, Ch. 21 to 69, preset to Ch. 38
Operating Voltage	187 - 264 V AC, 50 Hz
Power Consumption	175 W (max.), 35 W (typical) in standby
Dimensions	H = 73 mm, W = 360 mm, D = 320 mm (335 mm if a polariser is fitted)
Weight	4.4 kg (typical, when packed)

CONNECTORS

TV	SCART (CVBS), (RGB loop through only)
VCR	SCART (CVBS)
AV1 (AUX)	SCART
AV2 (DECODER/DESCRAMBLER)	SCART (Baseband Output, Audio/Video Input/Output, RGB in)
SPEAKERS	4 (right front, left front, surround and centre or surround) connected speakers must have an impedance between 4 Ω and 8 Ω
EXTERNAL AMPLIFIERS OUT	Phono (Left, Right, Centre, Surround, Surround)
MAINS INPUT	2-pin reversible
AERIAL	IEC female
TV	IEC male
LNB	Dual F-type

TUNER

Receiving Frequency Range	700 - 2150 MHz
Polarity Switching	Vertical: 12.0 - 14.0 V, Horizontal: 17.0 - 20.0 V at 0 - 400 mA with short circuit protection
LNB Tone Switching	Amplitude: 0.6 V ±0.2 V, Frequency: 22 kHz ±2 kHz
Input Impedance	75 Ω
I. F.	479.5 MHz
I. F. Bandwidth	27 MHz (27/15 MHz software selectable in non-VideoCrypt models)
Input Level	-60 dBm to -30 dBm
Image Rejection	40 dB (typically)
Static Threshold	6 dB (typically)
Energy Dispersion Removal	35 dB (min.)

SCART CONNECTORS

Video Output Level	1 V p-p (±2 dB)
Video Output Impedance	75 Ω
Video Frequency Range	50 Hz - 4.8 MHz (±3 dB)
Video De-emphasis (PAL)	to CCIR 405.1 (625 lines)
Baseband Output Level	1 V p-p (±2 dB)
Baseband Frequency Range	30 Hz - 10.5 MHz (±3 dB)
Baseband De-emphasis	PAL/MAC, software selectable
Audio Frequency Range	30 Hz - 12 kHz
Audio Output Level	500 mV RMS into 10 kΩ

OPERATING/STORAGE CONDITIONS

Operating Temperature Range	5 - 40 °C
Storage Temperature Range	-20 - +50 °C

OUTLINE SPECIFICATION (cont.)

AUDIO

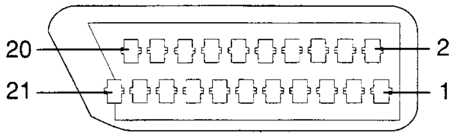
Audio Bandwidth	130, 180, 200, 280, 380, 500 or 600 kHz
Audio De-emphasis	PANDA 1, 50 µs, 75 µs or J17
Tuning Frequency Range	5.00 - 9.00 MHz in 10 kHz steps left and right frequencies independently tunable

KU-Band preset audio modes

Mode	Frequency	De-emphasis	Bandwidth
Stereo A	7.02 & 7.20 MHz	PANDA 1	130 kHz
Stereo B	7.38 & 7.56 MHz	PANDA 1	130 kHz
Stereo C	7.74 & 7.92 MHz	PANDA 1	130 kHz
Stereo D	8.10 & 8.28 MHz	PANDA 1	130 kHz
Mono 1	6.50 MHz	50 µs	200 kHz
Mono 2	7.02 MHz	PANDA 1	130 kHz
Mono 3	7.20 MHz	PANDA 1	130 kHz
Mono 4	7.38 MHz	PANDA 1	130 kHz
Mono 5	7.56 MHz	PANDA 1	130 kHz
Mono 6	7.74 MHz	PANDA 1	130 kHz
Mono 7	7.92 MHz	PANDA 1	130 kHz
Mono 8	8.10 MHz	PANDA 1	130 kHz
Mono 9	8.28 MHz	PANDA 1	130 kHz

PIN DESIGNATIONS FOR SCART CONNECTORS

Socket Viewed from Rear Panel



NOTE: The four SCART connectors are actually two double-SCART connectors mounted on the main PCB. On the circuit diagram these are SK2 and SK3 and the pins are numbered from 1 to 42, as shown in the table below. Example: Pin 3 of the VCR SCART is Left Audio Out and is shown as pin 24 on the circuit diagram.

Pin	TV SCART (SK2)	Pin	VCR SCART (SK2)	Pin	AV1 (AUX) SCART (SK3)	Pin	AV2 (DEC) SCART(SK3)
1	R Audio Out	22	R Audio Out	22	R Audio Out	1	R Audio Out
2	R Audio In	23	R Audio In	23	R Audio In	2	R Audio In
3	L Audio Out	24	L Audio Out	24	L Audio Out	3	L Audio Out
4	Audio Ground	25	Audio Ground	25	Audio Ground	4	Audio Ground
5	Blue Ground	26	Ground	26	Ground	5	Blue Ground
6	L Audio In	27	L Audio In	27	L Audio In	6	L Audio In
7	Blue Out	28	Not connected	28	Not connected	7	Blue In
8	AV Status Out	29	VCR Status In	29	Ext. Aux. Status In	8	Ext. Decoder Status In
9	Green Ground	30	Ground	30	Ground	9	Green Ground
10	Not connected	31	Not connected	31	Not connected	10	Not connected
11	Green Out	32	Not connected	32	Not connected	11	Green In
12	Not connected	33	Not connected	33	Not connected	12	Serial Data I/O Port
13	Red Ground	34	Ground	34	Ground	13	Red Ground
14	Not connected	35	Not connected	35	Not connected	14	Not connected
15	Red/SVHS Chroma Out	36	SVHS Chroma	36	Not connected	15	Red In
16	RGB Status Out	37	Not connected	37	Not connected	16	RGB Status In
17	Video Ground	38	Video Ground	38	Video Ground	17	Video Ground
18	Ground	39	Ground	39	Ground	18	Ground
19	Video Out	40	Video Out	40	Baseband Video Out	19	Baseband Video Out
20	Video In	41	Video In	41	Video In	20	Video In
21	Ground (Casing)	42	Ground (Casing)	42	Ground (Casing)	21	Ground (Casing)

OUTLINE SPECIFICATION (cont.)

ACTUATOR

Output to actuator motor	36 V DC (nominal)
Maximum continuous load	1 A RMS
Intermittent load	2 A 20% duty cycle
Intermittent starting surge	3 A max. (current-limited)
Overload protection	Current-limiting and foldback + thermal overload shut-off
Relay Switching	15 A heavy-duty relay
Position feedback type	Pulse counting
Pulse count range	0000 to 1999
Pulse repetition rate	1 pulse every 2 seconds (minimum), 80 pulses per second (maximum) Pulse width 6 ms (minimum)
Compatible actuators	Magnetic reed pulse generator or Photo interruptor pulse generator
Reed switch operating current	1 mA (maximum) (5 V source)
Photo interrupter supply	+5 V DC/50 mA maximum (nominal)

POLARISER

Mechanical

Supply voltage	+5 V maximum, 150 mA
Control pulse width	0.8 ms to 2.2 ms
Control output	5 V pk-pk
Resolution	64 steps

Electromagnetic

Control current	0 to ±80 mA minimum, ±12 V maximum
Resolution	64 steps
Short circuit protected	

RESETTING THE PIN AND GLOBAL RESET

The factory-set PIN is 1234. You can reset any customised PIN to the factory default as follows:

At the wall socket, disconnect the receiver from the mains supply. Hold down the ⏻ button **on the receiver's front panel** while you reconnect the receiver at the wall socket. You need to hold down the ⏻ button until the message "RESET PIN" disappears from the front panel display.

When the PIN is reset, the following also occur: any locked programmes or menus become unlocked, and, because the receiver has been powered down, the clock and any timers are no longer set.

Global Reset

To perform a global reset: Press the MENU key to put the Main Menu on the screen, then press the following keys in quick succession: 0 then STORE then ► then ◄.

A global reset causes the following to happen:

- All the options in the "Installation" sub-menus are reset to the values shown in the Menu Tree in the User Manual, **but note that in some early models of the receiver, LNB 1 and LNB 2 will be reset to 10.000 FSS High** (and not to 9.750 FSS Low which was downloaded at the factory). **This has important implications - see page 12.**
- The PIN is reset to 1234 and, if locked, the menus become unlocked (locked programmes are not affected). As you have not powered down the receiver for a global reset, the clock and timer settings are not lost.
- All the volume controls are reset to "half way"; the sound shapes are reset to those depicted in the User Manual.
- If a "power-on" programme has been set, the receiver is reset to power up into standby.
- Any sound modes which have been stored against AV1 and AV2 are reset to Normal mode.
- If you have a receiver which had special preset audio modes downloaded at the factory, these are reset to the standard Astra audio modes listed in the User Manual.

NOTE 1: As the UHF channel resets to 38, fine tune 0, you may need to do UHF tuning again.

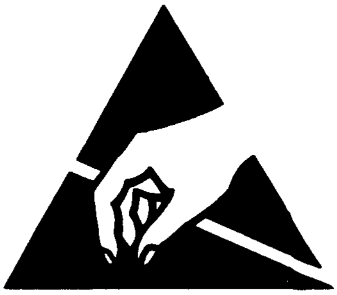
NOTE 2: As the receiver is reset to Speaker Configuration 1, you may need to alter this (depending on how the speakers and TV are actually set up) to hear the sound properly.

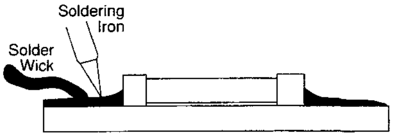
WORKING WITH CHIP COMPONENTS

Handling Electrostatic Sensitive (ES) Devices

Many semiconductor devices, such as integrated circuits and field effect transistors, can easily be damaged by static electricity. The following precautions should be observed when ES devices are being handled.

- Always use a grounded tip soldering iron and anti-static type solder removal devices.
- Before handling a device, discharge any electrostatic charge on your body by touching a known earth point - preferably use an earthed bench mat or ground mat together with a wrist strap.
- Do not remove an ES device from its protective packing until you are ready to fit it. Touch the protective material to the chassis or the assembly in which the ES device is to be installed, before removing the device from its packing.



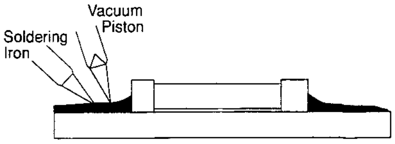


General Precautions for Handling and Storing Chips

Do not handle chips with your bare hands as this can cause oxidation on the chip's terminals which leads to poor soldering.

Do not store the chips in any of the following areas, as oxidation will occur and the capacitance and resistance will be affected:

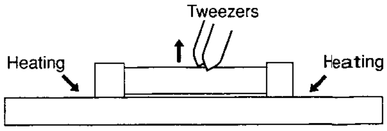
- areas with sulphur or chlorine gas;
- direct sunlight;
- areas of high temperature and/or high humidity.



Rough handling of circuit boards containing surface mount devices can cause damage to the components as well as the board; never bend or flex such boards.

Do not heat or cool the boards unnecessarily, as the board materials expand and contract by differing amounts which can cause the components and solder connections to be stressed.

Never rub or scrape chip components as this can change their value. Do not slide the board across any surface.



General Precautions for Attaching and Removing Chips

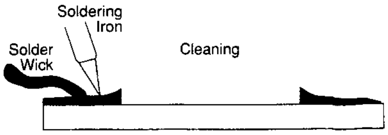
When using a soldering iron, take care and apply suitable pressure.

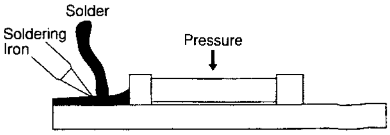
For preference, use a soldering iron rated at approx. 30 W with a thermostatic control to give soldering temperatures of approx. 225 to 250 °C.

Do not re-use chips which have been removed from the board.

When attaching chips, solder as quickly as possible so as not to damage the terminals and body of the chip. Do not touch the terminals directly with the soldering iron.

While soldering, keep the chip's body in contact with the board.





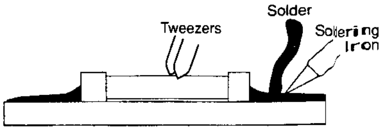
Removing a Chip

Heat the solder for 2 to 3 seconds at each terminal of the chip.

Remove the molten solder with solder wick.

Holding the chip with a pair of tweezers, remove it gently from the board while the solder at each terminal is molten.

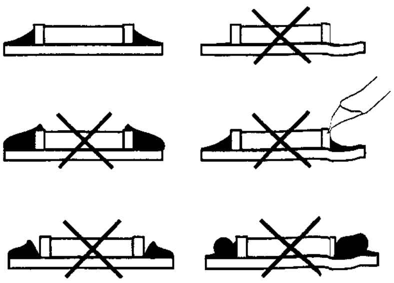
Wick off all excess solder from the board, so that it is ready for the mounting of new components.



Attaching a Chip

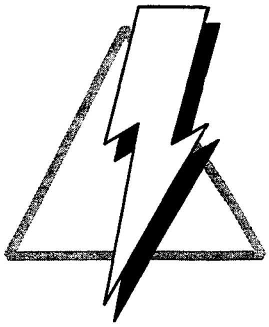
Place the chip in the correct position and temporarily solder one terminal to the copper surface.

Holding the chip body with a pair of tweezers to position it accurately, complete the soldering at each terminal in turn.



GAINING ACCESS TO THE UNIT

REMEMBER - SAFETY FIRST



WARNING: Always disconnect the unit from the mains supply before dismantling it.

WARNING: Remove your wrist strap before applying power to the re-assembled equipment to avoid potential shock hazards.

WARNING: The incorrect substitution of electrolytic capacitors may result in an explosion hazard.

CAUTION: Work on an earth mat and wear a wrist strap and earth lead to prevent electrostatic damage to components. Once the main board is removed from the casing it is fairly flexible, so handle it carefully to avoid damaging the components.

CAUTION: You must replace all the PCB fixings, screws etc. when the unit is re-assembled, otherwise there could be hazards due to reduced clearances.

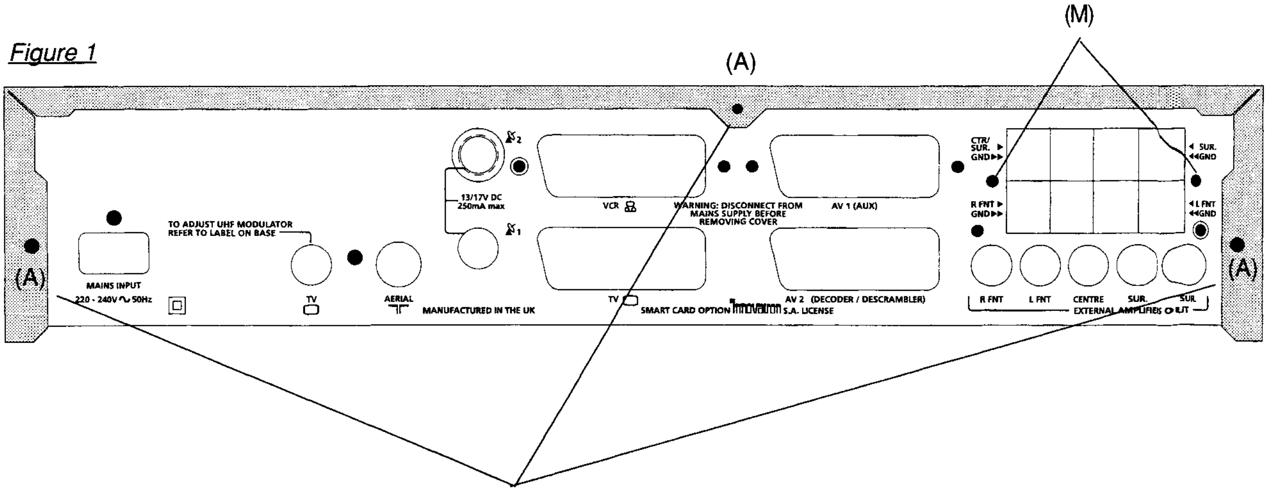
CAUTION: Before you apply mains power to the unit, always ensure that the voltage rating stated on the rear panel of the unit matches the mains voltage supply in the country of installation.

CAUTION: Do not spray chemicals on or near the unit.

CAUTION: Replacements for faulty components must be of the correct value and rating and must be assembled by a competent service engineer, otherwise safety approvals could be invalidated.

Removing the Cover (Figure 1)

Figure 1


(M)
(A)
(A)
(A)
13/17V DC
250mA max
VCR
WARNING: DISCONNECT FROM MAINS SUPPLY BEFORE REMOVING COVER
AV 1 (AUX)
CTR/
SUR. ▶
GND▶▶
◀ SUR.
◀◀GND
R FNT ▶
GND▶▶
◀ L FNT
◀◀GND
TO ADJUST UHF MODULATOR
REFER TO LABEL ON BASE
MAINS INPUT
220 - 240V ∿ 50Hz
TV
AERIAL
MANUFACTURED IN THE UK
TV
SMART CARD OPTION
S.A. LICENSE
AV 2 (DECODER / DESCRAMBLER)
R FNT
L FNT
CENTRE
SUR.
SUR.
EXTERNAL AMPLIFIERS OUT

Remove the 3 taptite screws (A) and slide the cover towards the rear.

REMOVING THE DISH POSITIONER MODULE FROM THE UNIT

With the cover removed from the satellite receiver:

Remove the 3 taptite screws from the 8 way push terminal on the rear panel of the receiver.

Crimp the stand-off prong at the front of the dish positioner board and remove the dish positioner board.

To remove the dish positioner board completely, disconnect the 12 way ribbon connector PL11 and the power connector PL5.

CIRCUIT DESCRIPTION

The receiver comprises four PCBs, some receivers may have an extension board in place of the main microprocessor U22 (see also the section entitled "Control Circuitry" later in this circuit description)

The adjacent "main" block diagram shows most of the main functional blocks. The VideoCrypt circuitry is on the main PCB but, for copyright reasons, the VideoCrypt decoder functions are given in a block diagram on a separate sheet. (See the pocket on the rear cover of the manual.) This separate sheet also contains a VideoCrypt circuit diagram and descriptions of the VideoCrypt and card reader functionality. There is also a separate block diagram for the audio circuitry (on page 24) which includes both the main board and sound board functions.

TUNER AND VIDEO PROCESSING (MAIN BOARD)

Tuner

When a programme is selected via the handset, data received by the sensor IR1 on the display board is fed, as TTL level data, to the microprocessor U1 for decoding. On the main board, microprocessor U22† receives data from U1 and supplies tuning data to a frequency synthesiser within the video processor U26. This synthesiser forms the reference oscillator for the phase locked loop which controls the local oscillator in the tuner (TUNER1). The prescaler output of the tuner is obtained by dividing the local oscillator frequency by 128.

The local oscillator is set 479.5 MHz higher in frequency than the chosen programme and is mixed with the incoming signal. The signal is then amplified by an IF stage centred at 479.5 MHz with a bandwidth of 27 MHz (15/27 MHz software selectable in some models). The 479.5 MHz FM signal is then demodulated in TUNER1 to give the required composite video baseband signal (CVBS) output.

The frequency synthesis is performed by U26, which receives divider ratio data for the required programme at pin 15 via the 3-wire serial bus from the microprocessor U22. The data is on pin 15, clock on pin 19 and select on pin 11 of U26. The synthesiser generates a reference frequency from the 4 MHz clock input on pin 12 of U26. This 4 MHz clock input is from the 16 MHz oscillator X3, which is divided by 2 in divider U31B and again by 2 in U31A. The prescaler input on pin 18 of U26 is divided down according to the divider ratio data sent from U22 and compared with the generated reference (see also the diagram on page 19). The error signal from this phase locked loop (pulses on pin 16 of U26) is integrated by Q52, R316, R315, C187 and R317. These determine how much of the 27 V supply appears as the tuner control voltage on pin 15 of TUNER1. The 5 V supply to the tuner is on pin 12.

To compensate for the LNB's local oscillator frequency conversion offsets, information about the position of the signal in relation to the 27 MHz(15/27 MHz software selectable in some models) bandpass filter within the tuner passes from pin 10 of TUNER1 to pin 15 of U22. The frequency synthesised within U26 can then be varied under control of the U22. This process, known as automatic frequency control (AFC) keeps the signal central in the 27 MHz (15/27 MHz software selectable in some models) bandpass filter.

The Tuning Menu can be used to specify whether a programme is received via LNB 1 or LNB 2. The select line (Pin 6 of TUNER 1) for LNB 1, is enabled by Q48; the select line for LNB 2 (pin 4) is enabled by Q47. Power to the LNBs passes through the tuner via pin 5 for LNB 1 and pin 3 for LNB 2. The line (LNB_SELECT) which controls both the supply and select for the LNBs comes from pin 6 of U25 in the control circuitry. There are further details about the LNB supply in the SMPS circuit description on page 19.

The baseband signal from pin 13 of the tuner passes via Q49 and Q51 or Q49, Q50 and associated components which invert the video for C-band signals. This is under the control of the line CBAND (from pin 12 of U25) which controls Q77 and occurs if the C-Band option at the Input Menu has been set to "Yes". The baseband signal is coupled into the audio circuitry via R559 and into the video processor U26 via R548, C184 and R311.

The baseband output from the tuner enters a pre-amplifier within U26 via pin 3. The gain of the pre-amplifier is set by R309 and R311 and the input is biased at about 2.5 V by R310 from VMID on pin 21. The pre-amplifier output on pin 2 is inverted. At this point there are two paths for the signal: one to give baseband output at pin 22 of U26 and the other to give video output at pin 6.

† Note: In receivers without VideoCrypt circuitry U22 functions differently.

- no software is included to operate the VideoCrypt or card reader circuitry.

† Note: If an internal MSS dish positioner is fitted U22 functions differently. There is

- an additional connection to U22;
- amended software.

Refer to the dish positioner service information on page 30 for further details.

Baseband Amplification

MAC and PAL transmissions use different pre-emphasis. The de-emphasis required for the incoming signal format, PAL or MAC, can be selected at the Decoder Output option of the External AV Menu (a sub-menu of the Set Up Programme Menu). This PAL/MAC selection switch is within U26 (but controlled from U22 via pin 24 of U26).

If PAL is selected, the response of the amplifier is modified by the PAL de-emphasis circuit R307, C181 and C613.

If MAC is selected, the response of the amplifier is modified not only by R307, C181 and C613 but also by R308 and C182 to give MAC de-emphasis.

The signal re-enters U26 at pin 1 and passes through the baseband amplifier whose output is inverted and is on pin 22 of U26 (OF1). This output is amplified by Q54 via C503 and associated components. The output, buffered by Q55, then passes to pin 19 of SK3 (i.e. at the AV2 (DEC) SCART) and and from Q56 to pin 40 of SK3 (i.e. at the AV1 (AUX) SCART)

Video Processing within U26

In the second path, the signal at pin 2 of U26 is PAL de-emphasised by the circuit R305, R306, C803 and C180 it then re-enters U26 at pin 4. The main video amplifier re-inverts the signal which comes out on U26 at pin 6. It then goes back in via C176 to pin 7 where it forms one of the three possible video inputs to the video source selection switch. The other possible video inputs to this switch are:

- from pin 20 of SK3 (i.e. the AV2 (DEC) SCART) which enters U26 at pin 8;
- from pin 41 of SK3 (i.e. the AV1 (AUX) SCART) which enters U26 at pin 9.

The selected video signal from this switch is then fed to a non-inverting contrast amplifier within U26 which can be varied under control from U22 (i.e. settings made at the Picture Menu). The output from this amplifier at pin 20 is then filtered.

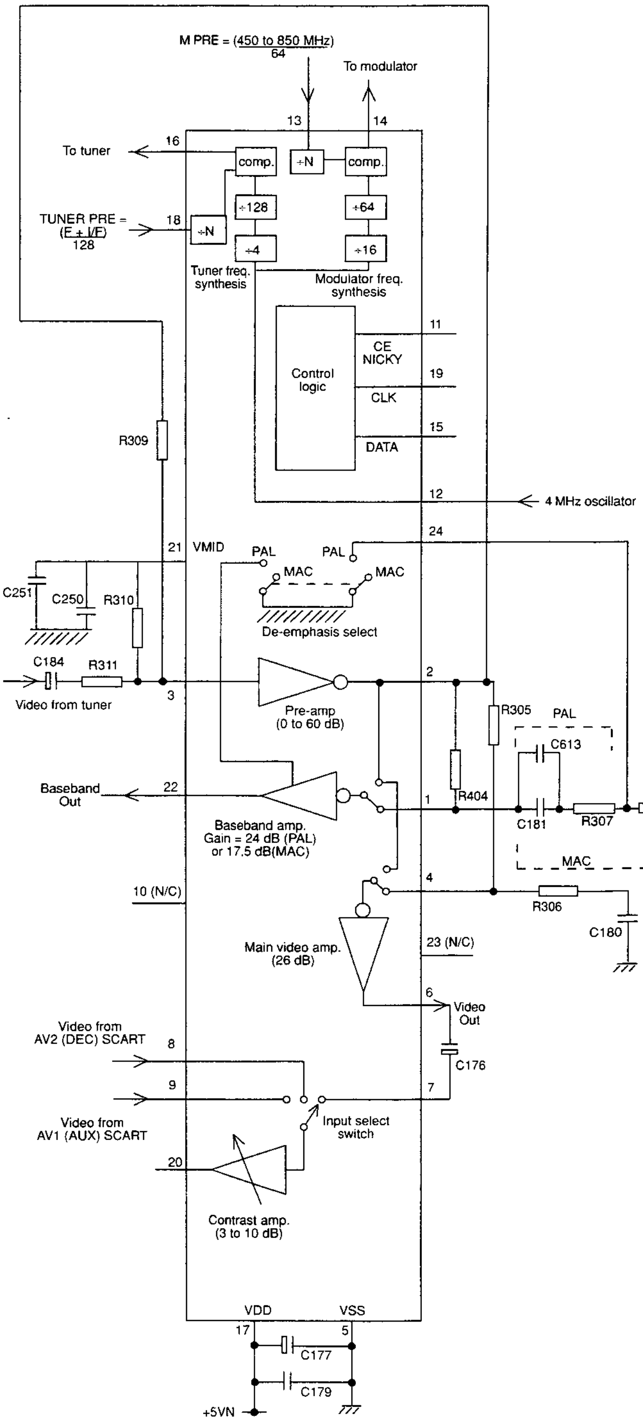
Note that for optimum operation of the VideoCrypt circuitry the contrast should be set between three and seven.

Video Filter and Phase Compensation

After the video signal has been amplified in U26, it is coupled to a low pass filter comprising L16, L17, C592, C583, C584, C189 and C190 which has a cut-off point of 5.0 MHz. Q53 and associated components provide phase compensation.

Amplifier and Sound Trap

After being filtered and phase-compensated the video signal passes through an amplifier and sound trap (Q57, Q58, L18 and associated components) to remove any residual audio sub-carriers. It then passes to the energy dispersal clamp.


M PRE = (450 to 850 MHz) / 64
To modulator
13
14
To tuner
16
comp.
÷N
comp.
÷128
÷64
TUNER PRE = (F + I/F) / 128
18
÷N
÷4
÷16
Tuner freq. synthesis
Modulator freq. synthesis
Control logic
11
CE NICKY
19
CLK
15
DATA
12
4 MHz oscillator
24
R309
21
VMID
PAL
PAL
MAC
MAC
De-emphasis select
C251
C250
R310
C184
R311
Video from tuner
3
2
Pre-amp (0 to 60 dB)
R305
PAL
C613
R404
Baseband Out
22
1
R308
C181
R307
C182
MAC
Baseband amp. Gain = 24 dB (PAL) or 17.5 dB(MAC)
10 (N/C)
4
R306
C180
23 (N/C)
Main video amp. (26 dB)
6
Video Out
C176
Video from AV2 (DEC) SCART
8
9
7
Video from AV1 (AUX) SCART
Input select switch
20
Contrast amp. (3 to 10 dB)
VDD
VSS
17
5
C177
C179
+5VN

Energy Dispersal Clamp

Most satellite signals are transmitted with energy dispersal to distribute the energy more evenly across the transmission bandwidth. Energy dispersal is a triangular 25 Hz waveform added to the signal. If energy dispersal is not removed flickering can occur on the screen.

To remove the energy dispersal 25 Hz triangular modulation, the video signal is low pass filtered by R825 and C620, buffered by Q117 and AC coupled by C619. The transistor Q100 acts as a sync. tip clamp which produces a horizontal sync. pulse. The clamp reference is set by the signal V_REF (which comes from the VideoCrypt circuitry) operating through Q98, R340 and R239 on the drain of Q118. Where there is a clamp pulse at Q118, it is turned on so that charge passes through Q118, L19 and R824 to ensure that the voltage at the junction of L19 and C194 is the same as at the positive side of C198. In this way, the bottom of the sync. pulse of the video is clamped to 2 V.

Sync. Separator

The clamped video signal passes via buffer Q62 to pin 1 of U17 and also into the VideoCrypt circuitry† (see also the VideoCrypt circuit description on the separate sheet). In the VideoCrypt circuitry it is buffered by Q64 and AC coupled by C207 into pin 19 of U29, the sync. separator. The microprocessor U29 has a phase locked loop with a free-running VCO which uses the ceramic resonator X5; if not locked, this will generate free-running horizontal and vertical sync. pulses.

If a valid video signal is detected at pin 19 of U29 the following happen:

- the horizontal and vertical sync. pulses are locked to the video;
- the STATION_ID line emerging at pin 7 of U29 goes high to 12 V (subsequently divided down to 5 V by R746 and R39) to show that the receiver has locked onto a signal (this line also controls other functions in the video circuitry - see the descriptions which follow).

The horizontal and vertical sync. pulses (on pins 12 and 15 respectively of U29) are needed for the VideoCrypt functions and are also fed to pins 30 and 31 respectively of U7, the colour graphics generator (see below).

† Note: In receivers without VideoCrypt circuitry ignore the pink VideoCrypt sheet, but note the following:

- U29 and associated components remain (U29 is required for horizontal and vertical sync. extraction and station ID);
- the clamped video signal only passes via Q62 to pin 1 of U17.

At U17 non-scrambled signals are switched through from pin 1 to pin 15, whereas descrambled signals emerging from the VideoCrypt circuitry are switched through from pin 2 to pin 15 of U17. This switching at pins 1 and 2 of U17 is under the control of the main microprocessor U22 and is described in detail in the VideoCrypt circuit description on the separate sheet.

As an aid to troubleshooting you can put the receiver into a test mode† which forces all the signals to pass through the VideoCrypt path. To do this, put the Main Menu on the screen, then press the following keys in quick succession: 0 then STORE then RCL then TV/SAT. To exit this mode you must press 0, STORE, RCL, TV/SAT.

† Note: In receivers without VideoCrypt circuitry there is no test mode which forces all the signals to pass through the VideoCrypt path.

The selected video at pin 15 of U17 via R348 through emitter follower Q101, is AC coupled by C200 and R348 and fed to buffer Q63. The video signal is diode clamped to approx. 3 V by D48, to give the right DC level and then passes to pin 40 of SK2 (i.e. the video output at the VCR SCART, PL30-4). The video signal to the VCR is fed off at this point so that any on-screen graphics generated in the satellite receiver are not recorded. Note that video to a UHF-connected VCR can contain on-screen graphics which **will be recorded.**

The video signal passing via Q63 is also divided by 2 (resistors R349 and R420) and buffered by Q105 (OFF3) to enter the colour graphics generator U7 at pin 13.

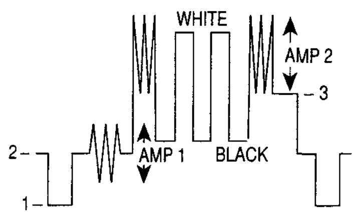
Colour Graphics Generator

This is U7 and associated components and it is used to generate the menu background colour and on-screen text characters, under control from the microprocessor U22. There is a choice of eight menu background colours, chosen at the Picture Menu. There are two graphics modes: plain background and superimposed on a picture.

There are two oscillators associated with U7. The first oscillator is the crystal X4 which generates a frequency of 17.734 MHz. This is exactly 4 times the frequency of the colour information which is used to generate the background colour(s) and is therefore relevant to plain background mode. If this frequency is not within a few hundred hertz of 17.7344 MHz, there may be no colour to the on-screen graphics display (it depends on the tolerance of the TV set). The second oscillator is within U7 and it runs at approximately 7 MHz, its frequency being set by external components L15, C174 and C175. This is used, together with horizontal and vertical sync. pulses, to generate the character positions on the screen. For the superimposed mode the horizontal and vertical sync. pulses come from U29 and enter U7 at pins 30 and 31 respectively. For plain background mode the horizontal and vertical sync. pulses are generated within U7 by X4.

For both modes, the black and white voltage levels for the characters are generated by the resistor chain R294, R292, R291 and R293 on pin 14 for black and pin 15 for white.

For a TV screen showing graphics on a plain coloured background, one line of the video signal looks like the adjacent figure. The various levels shown and the amplitude of the bursts are determined by the components associated with specific pins of U7. A table of these pins is given below the figure.



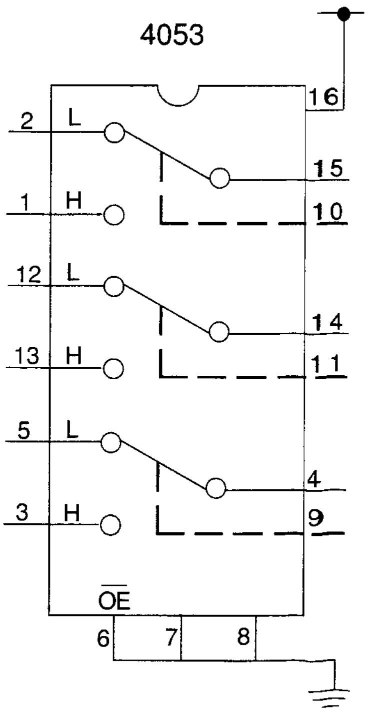
Parameter	Pin
Level 1	9
Level 2	16
Level 3	17
Black level	14
White level	15
Amplitude 1	20
Amplitude 2	19

The video signal which enters U7 at pin 13 therefore emerges at pin 12 with any superimposed graphics such as menus, programme status information etc.

U7 also generates a composite sync. output on pin 27. This output is used to put sync. pulses onto the noise which is present when there is no valid video signal. These sync. pulses are needed in order to insert graphics onto noise; pin 23 of U7 is the graphics output for this purpose.

On-screen Graphics without a Valid Video Signal

This is provided by U32 and associated components. U32 is a 4053 switch whose control lines (and the switch positions when these lines are high (H) or low (L)) are shown right.



When the STATION_ID line from pin 7 of U29 is high (D68, C558 and R712 provide debounce if this signal is noisy), pin 10 of U32 switches the video signal at pin 1 of U32 (which has come from pin 12 of U7) to pin 15 of U32 and buffer Q107.

The STATION_ID line also goes to pin 33 of the main microprocessor U22. Generally, if the line is low, U22 sends a message to U7 via the data bus to switch in a plain coloured screen with the words "NO SIGNAL" on it. However, if you have pressed "F, STORE", this plain screen is cancelled and you can see the noise on the screen. If the STATION_ID line is high, U22 generally commands U7 to superimpose graphics onto a picture for the Tuning Menu (and similar menus). However, if you have pressed the TV/SAT key while the menu is displayed, U22 commands U7 to insert a plain coloured background instead of the picture.

The signal (labelled OFF 3 in the circuit diagram) which goes to pin 13 of U7 also goes to pin 5 of U32. The signal path through U32 (via pins 4, 13, and 14) is only relevant for noise (i.e. when the STATION_ID line is low), as only in this case is the signal (noise) switched through from pin 2 to emerge at pin 15.

When the STATION_ID line is low, transistor Q78 switches off. This allows pin 11 of U32 to go high and low with the compsync. signal (which comes through R446 from pin 27 of U7). When it is high, the noise signal entering U32 at pin 13 passes through to pin 14. When it is low (i.e. during the sync. pulse period) pin 12 connects with pin 14 so the sync. pulse itself emerges at pin 14, its DC level being set by R444, R445 and C263. In this way the sync. pulses are added to the noise signal, which is a prerequisite for graphics insertion onto the noise signal.

The insertion of on-screen graphics characters onto the noise signal is controlled by the CHAR line from pin 23 of U7 which goes to pin 9 of U32. When this line is low, the noise signal entering at pin 5 of U32 passes through to emerge at pin 4. When this line is high, pin 3 connects with pin 4 to set the white level of the character to the voltage determined by R442 and R443.

Audio/Video Source Selection and SVHS Chroma Switch

The video output from pin 15 of U32 is buffered by Q107 and passes to pin 1 of U30 (see Modulator Signal Selection on page 17) and to pin 4 of U21 which is not only the video source selection switch, but also the SVHS chroma switch. Pin 3 of U21 is the video output to the TV SCART, whereas pin 13 is the SVHS chroma output to the TV SCART (and also red for RGB).

U21 is a 4052 switch; a diagram is given right. It is controlled by both lines at pins 9 and 10, so a truth table is given below the diagram to show how connections made within the switch are controlled by the status of these lines.

The voltage level at pin 4 of U21 has been fixed by the preceding circuit. The DC voltages at pins 2, 5 and 1 are set to match this by the biasing resistors R261 and R260 from a potential divider R262 and R265.

Pin 9 of U21 is the TVSTAT control line; if TVSTAT is high then pin 9 is low (because it passes through inverter/driver Q42). Pins 1 and 5 of U21 are connected together and are the video input from pin 41 of SK2 (i.e. pin 20 of the VCR SCART). The truth table shows that whenever pin 9 is low, because pins 1 and 5 of U21 are connected, the video input from the VCR is switched through U21 to pin 3 (and therefore to the TV SCART). This is independent of the status of the AV/AUDIO line on pin 10.

When the VCR is set to play, the line VCRSTAT at pin 8 of the VCR SCART (i.e. pin 29 of SK2) goes high, which in turn commands the microprocessor U22 to set the TVSTAT line high ("VCR Play" is displayed on the front panel). The TVSTAT line also goes high when the TV/SAT key is pressed until "VCR ➔ AV" is displayed on the front panel.

The truth table shows that when pin 9 of U21 is low the following also happens: either pin 12 or pin 14 (both of which are from the VCR SCART) is connected to pin 13 which goes via Q109 to pin 15 of the TV SCART. As pins 12 and 14 are connected, this means that SVHS chroma from pin 15 of the VCR (i.e. pin 36 of SK2) is always routed through U21 to the TV SCART when the VCR video signal is routed through U21. Note that pin 15 of the TV SCART is also linked to pin 15 of the AV2 (DEC) SCART. (Note that pin 15 is for red, and also that pin 7 for blue and pin 11 for green are linked through from the AV2 (DEC) SCART to the TV SCART).

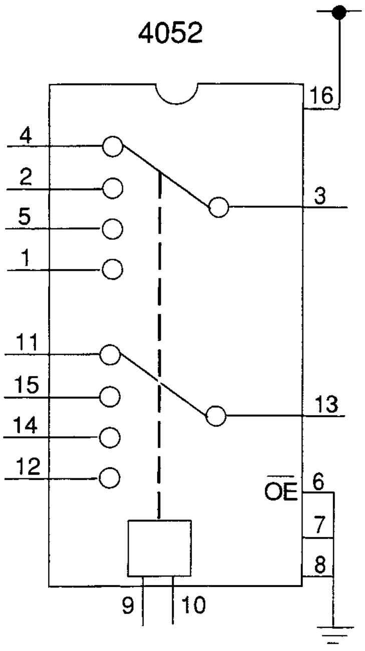
If pin 9 of U21 is high (i.e. the TVSTAT line is low), the VCR is not selected as the video source. In that case it is the status of the AV/AUDIO line at pin 10 of U21 which determines what is routed to pin 19 of the TV SCART as follows:

- if AV/AUDIO is low, then the video input at pin 20 of the TV SCART is routed through the receiver to pin 19 of the TV SCART;
- if AV/AUDIO is high, then the video signal from the satellite video circuitry is routed to the TV SCART (note that this video signal could initially have come from the satellite programme or from equipment connected at the AV1 (AUX) or AV2 (DEC) SCARTS - see the section about video processing within U26 on page 13).

When the TV/SAT key is pressed so that "TV ➔ AV" appears on the front panel, the microprocessor U22 causes the AV/AUDIO line at pin 13 of U25 to go high, this is then inverted by Q76, so that the AV/AUDIO line is low at U21 and U20. This therefore loops the TV signal input on pin 20 back to the TV via pin 19 of the TV SCART.

In the first of these cases, the audio input at the TV SCART is routed through into the audio processor U18 and back out to the TV SCART, as the AV/AUDIO line also controls the switch U20 (see the audio circuit description on page 24 and the audio block diagram, and note also that U20 is a 4053 switch). This is logical because if you are viewing a terrestrial channel, you will also wish to hear the terrestrial audio, and, if it is routed through the receiver, home cinema effects (only available on MSS 1000 series receivers) can be applied if required. In these conditions pin 8 of the TV SCART is high.

In the second case, the audio from the AV1 (AUX) SCART is routed into U18 which controls which of the various audio sources is routed to the TV SCART - see the section on Audio Baseband Processing and Signal Routing on page 25.



pin 9	pin 10	connections
high	high	3 to 4, 13 to 11
high	low	3 to 2, 13 to 15
low	high	3 to 5, 13 to 14
low	low	3 to 1, 13 to 12

RGB Disable Switch

Pins 12, 13 and 14 of U20, the RGB disable switch, are controlled in two ways.

The first control method is via pin 11 which goes low when pin 16 of the AV2 (DEC) SCART (the RGB status line) goes high (note that Q38 inverts the signal). When pin 11 is low, pin 12 is switched to pin 14 of U20, and if pin 12 is at 5 V, transistor Q113 is turned on. This in turn causes pin 16 of the TV SCART to go high so that RGB status is enabled. If pin 16 of the AV2 (DEC) SCART is low, then pin 11 of U20 goes high and pin 14 of U20 connects to pin 13 (i.e. ground), which disables RGB status at the TV SCART.

The second control method is pin 8 of the AV1 (AUX) SCART (i.e. pin 29 of SK3). If this goes high, its inversion by Q112 means that pin 12 of U20 is pulled low. This means that although the connection remains from pin 12 to pin 14 of U20, transistor Q113 does not turn on and therefore pin 16 of the TV SCART is low (i.e. the RGB status line is disabled at the TV SCART).

In practical terms, RGB from the AV2 (DEC) SCART (pins 15, 11 and 7 respectively) is always present at the TV SCART, but can only be used by the TV if the RGB status line on pin 16 goes high (for example if a video source is connected to AV2). If you wish to watch a video source attached to AV1, the RGB from AV2 must firstly be disabled, by setting pin 8 of AV1 high (which often occurs automatically when the video source at AV1 is set to "On", or can be forced by pressing the 0 (AV) key until "AV1" is displayed on the receiver's front panel).

VCRSTAT Routing

The VCRSTAT line is bi-directional between D71 and the microprocessor U22. It can be an input at pin 32 to inform U22 about the status of pin 8 of the VCR SCART (pin 29 of SK2). It is also used as an output to control the status of pin 8 of the TV SCART. This can be maintained in a given state by R108, R109 and C602 while the VCRSTAT line is momentarily changed during the reading of pin 8 of the VCR SCART (i.e. pin 29 of SK2). Once U22 has been informed that pin 8 of the VCR SCART has gone high, pin 32 of U22 becomes an output for the VCRSTAT line. U22 now sets the VCRSTAT line to high in order to drive the pin 8 of the TV SCART high (which is what is needed if the VCR is playing). Diode D71 prevents the VCRSTAT line from driving pin 8 of the VCR SCART high if the VCR is not playing and also prevents pin 8 of the VCR SCART from holding the VCRSTAT line low.

Modulator Signal Selection

The video signal at Q107 emitter not only passes to the source select U21, but also to pin 1 of U30. Pins 1, 2 and 15 of U30 are the modulator signal select switch, which is controlled by the line MOD_VID_SRC on pin 10. (Note that U30 is a 4053 switch and its other pins are used for audio signal routing - see page 26.)

The MOD_VID_SRC line comes from pin 25 of the microprocessor U22 and is generally high, which means that the video input at pin 1 is routed through to pin 15 and from there through buffer driver Q61 to the modulator.

The input at pin 2 of U30 is the VCR video signal which has come from SK2-41 and pins 1 and 5 of video source select switch, U21. This is switched through to pin 15 of U30 if the MOD_VID_SRC line is low. This only occurs when either "VCR Play" or "VCR ➔ AV" is displayed on the front panel and the receiver is in Speaker Configuration 2 or 4 (only applies to MSS 1000 series models). Note that because this video goes to the modulator after it has had graphics added these will be recorded if a VCR is connected to the receiver by a UHF lead. (Video to the VCR SCART cannot contain on-screen graphics, as described previously.)

The switch U30 is disabled for Speaker Configuration 3 (under control from pin 4 of U18). This is done to mute the sound to the TV SCART automatically if there is a separate centre speaker. However, this would result in no video at all reaching the UHF modulator, so there is a by-pass which causes the video on pin 1 of U30 (under control from pin 4 of U18) to be connected through Q116 to pin 15 of U30 and thereby to the modulator. Therefore it is important to note that if Speaker Configuration 3 is selected and the TV is connected to the receiver by a UHF lead only, then it is not possible to see video from the VCR on the TV screen (although you can hear the VCR audio at the speakers). Note also that if the TV and receiver are connected by UHF lead only that you must use the TV handset to mute the sound to the TV, it does not occur automatically as it does when there is a SCART connector. See also the audio description for the TV SCART output on page 26.

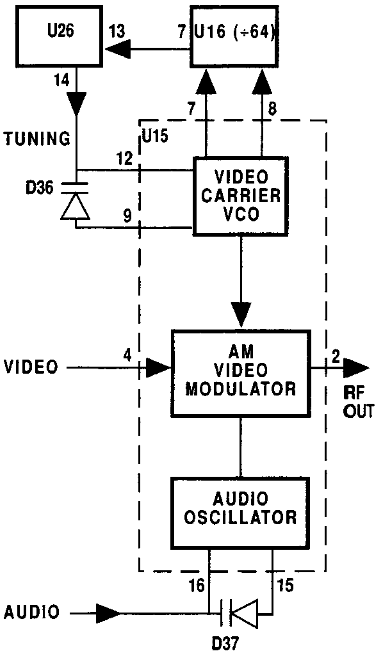
UHF MODULATOR (MAIN BOARD)

The RF output to the TV is generated by a frequency synthesised UHF modulator. This allows the RF output to be precisely tuned to any channel within the UHF bands IV and V (channels 21 - 69).

The circuitry consists of two main component parts, a loop-through amplifier between the aerial input and the output to the TV/VCR, and the UHF modulator itself, which comprises U15, U16 and associated components. The circuitry requires two power supply inputs, one to supply the amplifier (+12 V, which is always active) and one to supply the UHF modulator itself (+5 VMOD, which is powered off in standby mode).

The heart of the modulator is the IC U15, a block diagram of which is shown adjacent. It comprises the following:

- a voltage controlled oscillator that covers the full UHF band;
- an audio oscillator for the sound sub-carrier;
- an amplitude modulator to modulate the UHF carrier with the video;
- a video automatic gain control and clamp to ensure the correct modulation index.



The VCO within U15 is formed by the tuned circuit connected to pins 9,10,12 and 13 of U15.

Tuning is enabled by a DC tuning voltage in the range 0 to 24 V being applied to the varicap diode D36.

Differential outputs from pins 7 and 8 of U15 are fed to pins 3 and 2 respectively of prescaler IC U16, which divides them by 64. The output from pin 7 of U16, which should be in the range 7.1875 MHz to 13.4375 MHz, is fed into the UHF modulator's phase locked loop circuitry within U26 at pin 13 (see also the diagram of U26 on page 13).

The tuning voltage is derived from pulses on pin 14 of U26. They are integrated by Q32, Q33 and associated circuitry and eventually fed to the cathode of D36.

The audio subcarrier oscillator tuned circuit is connected across pins 15 and 16 of U15. This is set at the audio subcarrier frequency (6 MHz for PAL I; 5.5 MHz for PAL G). The audio signal from U19C is fed to the varicap diode D37 which is biased at approximately 8 V. This causes the oscillator to be frequency modulated. C126, C127, R211 and R212 (which are in the audio circuitry near U18) provide audio pre-emphasis.

The video signal (labelled OF10 in the circuit diagram) is fed into pin 4 of U15 via a video filter C96, L13 and C95. The video signal (not the filter) is used to amplitude modulate the VCO output. The modulation index is set to be 80% by resistor R197 on pin 3 of U15.

The output from pin 2 of U15 is fed via a high pass filter (C71, L9 and C70) and a resistive pad (R180, R179 and R178) into a balun L8 which mixes the signal with the terrestrial video signals.

The loop-through amplifier comprises Q30 and Q31. Inputs from the terrestrial antenna pass through a resistive pad (R165, R164 and R163) and a 27 MHz high pass filter C57 and L7. Lightning protection is provided by D35. There is also further high pass filtering by C56, L6 and C55. RF and DC feedback are provided by R160. The output of gain stage Q30 is then fed through another resistive pad (R166, R167 and R168) to give good reverse isolation. RF and DC feedback for Q31 are provided by R169. The output from Q31 feeds the balun L8 and passes to the TV via the rear panel UHF connector. This balun prevents the remodulated satellite signals being sent to the aerial input and thereby being broadcast. Note that a high level terrestrial signal input (e.g. if an aerial amplifier is used) can attenuate the satellite signal output.

SWITCH MODE POWER SUPPLY (MAIN BOARD)

Mains Input and Rectification

Diodes D1, D2, D3 and D4 rectify the AC mains voltage and, together with smoothing capacitor C2, provide the DC input HT for the SMPS. C1 and T1 form a mains filter to minimise the feedback of RFI into the mains supply. Asymmetrical mains pollution is reduced by the insertion of R40 and C21 between the primary ground and the secondary chassis ground. These components are needed to satisfy the mains isolation requirements and are safety-critical components (as are SK1, FS1, T3 and U2). These components (and R1 which limits the surge current on power-up) must only be replaced by components of the correct type (see parts lists).

SMPS Controller U1

The start-up supply for U1 is obtained via R5, R367 and R804 which charge C6 to approximately 16 V before U1 will power up. C6 sustains a charge long enough for the switch mode supply for U1 of 12 V to be obtained from a feedback winding of the transformer T3, rectified by D8. The frequency of the switch mode is set by R369 and C4 and should be 25 to 30 kHz. D5 and D55 provide surge protection for U1.

The secondary supplies are regulated by sampling the +5 V. This sample is provided by R13 and R12 and is fed to the control pin of a variable voltage Zener diode D9. This control voltage is 2.4 V under normal conditions and can be measured at the junction of R12 and R13. The voltage on the cathode of D9 varies, thereby controlling the current through the LED within U2. This in turn varies the conduction of the internal transistor in U2.

A reference voltage of 5 V is available at pin 8 of U1. This is applied to pin 5 of U2, the collector of its internal transistor. The emitter voltage at pin 4 of U2, which varies with the conduction of the transistor, is applied via a potential divider, R3 and R4, to pin 2 of U1. This is the input of a comparator within U1 which controls the "on" time of Q1, thereby regulating the secondary supplies. R2 and C270 control the feedback loop gain of the comparator.

Excess energy from the switching of Q1 is dissipated in a snubber network R7, D6 and C7. The voltage on Q1 is limited by R110, D72 and C295. Overcurrent protection is given by R9, R710, R711, R594, R9A, R710A, R711A and R594A.

Secondary Windings of T3

The secondary windings of the transformer T3 provide the following: +5 V (pin 3), +12 V unregulated (pin 5), +20 V (pin 6), -21 V (pin 7), +30 V (pin 8) and +33 V (pin 1). The LNB supply is derived from the +20 V or +12 V unregulated supply, depending on the polarisation. The +12 V supply is obtained from the +12 V unregulated supply using REG1. The +27 V tuning voltage is derived from the +30 V supply using D18. The +8 V supply on pin 39 of U18 is derived from the +12 V supply using D38 (this +8 V supply also goes to the sound board via PL4-9). The -8 V supply is derived from the -21 V supply using D62 and R645 (below U18 on the circuit diagram), the 8 V supply also goes to the sound board via PL4-1. The +33 V supply goes to the sound board to supply the power amplifiers there; the path is via PL38 on the main board, but on some receivers (see ECO S000498) it is via the alternative connector PL5.

LNB Supply Switching

Q4 in association with U3B acts as a voltage regulator for the LNB supply; R26 and Q5 provide current limiting for it. The LNB supply can be switched off by Q72 under the control of the line LNB_ON/OFF from pin 4 of U25 and occurs if there is an LNB short (see below). The status of the line LNB_ON/OFF is also determined by the setting made at the "LNB Power" option at the LNB Menu in combination with the setting at the "LNB" option at the Tuning Menu (i.e. the LNB_SELECT line). This is shown in the following truth table, where "On" also indicates that an LNB supply voltage is present at the emitters of Q43 and Q44 (near the tuner).

"LNB Power" setting in LNB Menu	"LNB" setting in Tuning Menu	
	1	2
None	Off	Off
1	On	Off
2	Off	On
1 or 2	On	On

If the “LNB Power” option is set to “1 or 2” then the LNB supply is always present at the junction of Q43 and Q44. It is directed to the receiving LNB under the control of the LNB_SELECT line, the switching being carried out by Q44 for LNB 1 and Q43 for LNB 2.

LNB Short-Circuit Detection

U3A acts as a comparator to detect a short-circuit condition and indicates a short if the LNB voltage drops below 8 V. When this occurs the LNB_SHORT line informs the main microprocessor U22 which switches off the LNB supply via the LNB_ON/OFF line and also causes the message !!WARNING!! LNB SHORT to be displayed on the TV screen. Thereafter, the software keeps switching the LNB power on for half a second and off for a whole second to check whether the short-circuit is still present.

Polarisation Switching

If the Polariser type option in the Input menu is set to Volt, the setting of horizontal (H) or vertical (V) polarisation at the Tuning Menu causes the control line H/V POLARITY from pin 14 of U25 to switch Q9 and Q73 in the PSU circuitry “on” or “off”. If Q73 is “on” then the LNB supply is 18 V (which is required for horizontally polarised signals) and Q6 switches R37 into the reference feedback circuit on pin 2 of U3B. If switch Q73 is “off” then D22 will conduct and the LNB supply wii be 13 V (for vertical polarisation) and R37 is not switched in by Q6.

22 kHz Oscillator and Tone Switching

Q12 and Q13 are part of a 22 kHz oscillator which runs constantly. This is used to drive the filament of the vacuum fluorescent display on the front panel of the receiver and hence light it up. This supply line to the display is labelled FP-FILAMENT and passes via the ribbon cable between PL2 on the main PCB and PL1 on the display PCB.

The 22 kHz signal from oscillator is also used as a tone which can be added to the LNB supply via Q7 and Q11. This tone is switched to the LNB supply by Q7, which is controlled by the line TONE_ON/OFF from pin 22 of the main microprocessor U22. The status of the TONE_ON/OFF line is determined by the setting “On” or “Off” at the “Tone” option in the Tuning menu or if the “Band” option in the St Up Programme Menu is set to “Multiband tone” or “Universal LNB”.

Power Supplies During Standby

When the receiver is put into standby, the STBY line from pin 5 of port expander U25 goes low which turns transistor Q3 off. This disables U17 by switching pin 6 high, so that all video from the satellite receiver disappears from the TV screen. If Q3 is off, then Q2 is also off which therefore means that there is no 5 V supply (+5VMOD) to the modulator itself, but the 12 V supply to the loop-through amplifier in the modulator circuitry is maintained, so that terrestrial signals can continue to be routed through the satellite receiver when it is in standby.

DISPLAY BOARD

The circuit diagram for the display board is on the separate sheet at the rear of this manual. The display board comprises an infra-red sensor for the handset commands, the front panel buttons and dial, a vacuum fluorescent display (VFD1) and a microprocessor U1 which controls what appears on the VFD and also the passage of information to the microprocessor U22 on the main PCB.

When the receiver powers up, the reset line RST (from the main board), initially low, causes pin 63 of U1 to go high. The data, clock and interrupt logic are seen on pins 12, 11 and 4 respectively of U1 and these pass to the main PCB on pins 8, 7 and 6 of PL1 via a ribbon cable to PL2 on the main PCB. When the handset keys are pressed, IR data (see Oscillogram 21) is on pin 13 of U1. The microprocessor U1 runs at 4 MHz, determined by crystal X1.

Front Panel Switches and LEDs

The diagram (see page TBA) shows a simplified version of the switching circuitry. At any instant, output pins 5 and 6 of U1 can never both be high, although they will both be low when the receiver is in standby. Pin 5 being high causes LED2 (the programme selector LED) to illuminate; pin 6 being high causes LED1 (the volume LED) to illuminate. These LEDs can never be illuminated simultaneously, but will both be extinguished during standby.

The microprocessor U1 checks to see whether the front panel switches are open or closed as follows. It sets pin 5 low (and therefore pin 6 high) momentarily and checks whether pin 14 is high or low. If it is low, then SW3 (the programme selector button) must be closed; if it is high then SW3 must be open. While pin 5 is still low, U1 then checks whether pin 8 is high or low. If it is low then SW4 (the surround sound button) must be closed; if it is high then SW4 must be open. To check the other two switches, U1 then sets pin 6 low (and therefore pin 5 high) momentarily and checks again whether pin 14 is high or low. If it is low, then SW1 (the volume button) must be closed; if it is high then SW1 must be open. While pin 6 is still low, U1 then checks whether pin 8 is high or low. If it is low then SW2 (the standby button) must be closed; if it is high then SW2 must be open.

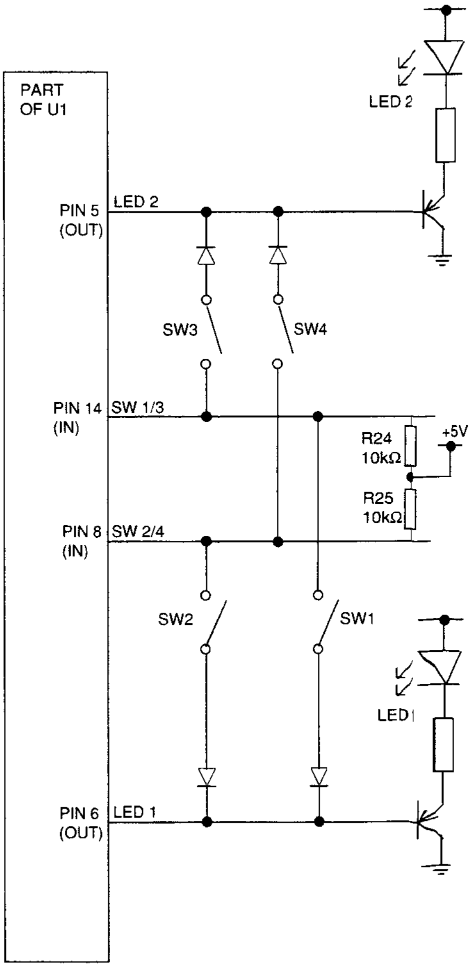
This checking of the switches is done very quickly, so that if an LED is extinguished, the very quick switch-on when a pin goes high is not noticeable to the eye (or if the LED is illuminated, a very quick switch-off when a pin goes low is not noticed).

If SW2 is detected as being closed, U1 sets both pins 5 and 6 low (except for the short time during which it does the checks) so that both LEDs extinguish and U1 causes the word "Standby" to be illuminated on the VFD.

If SW3 is closed then U1 sets pin 5 high and pin 6 low (except for the short time during which it does the checks) so that only LED 2 is illuminated. If SW1 is closed then U1 sets pin 6 high and pin 5 low (except for the short time during which it does the checks), so that only LED 1 is illuminated.

The closing and opening of SW4 causes a stepping through the four sound modes for home cinema effects (only in MSS 1000 series receivers). U1 keeps track of which sound mode is currently applied and steps to the next in the sequence if a change in SW4 is detected.

The presence of the diodes D1, D2, D3 and D4 prevent LED 1 and LED 2 illuminating simultaneously if the buttons are pressed simultaneously.



Front Panel Dial

This is a digital rotary switch (SW5) which has a common 5 V supply and two outputs which each have a 10 kΩ pull-down resistor (R15, R16). As the potentiometer is rotated clockwise (right) or anti-clockwise (left), there are 5 V pulses to pins 9 and 10 of U1. The sequence of these pulses is decoded by U1 and sent to the microprocessor U22 on the main board (which in turn controls the tuning or volume control circuitry).

Vacuum Fluorescent Display

The supply to the VFD is FP_FILAMENT which comes from the 22 kHz oscillator supply on the main PCB via the ribbon cable between PL1 on the display board and PL2 on the main board. It is AC coupled via C22 and drives transistors Q5 and Q6, which act as a push-pull pair. This provides an 8 V peak-peak square wave (50% mark to space ratio) which is then AC coupled via C2 and drives the filament wires within the VFD (these can be seen as thin horizontal wires across the front of the display). The resistors R32, R1, R33, R34 and R2 hold the filament wires at 16 V.

The supplied current to the filament wires causes them to heat up and emit electrons. When a segment of the display is turned on (by the application of a positive voltage) the segment attracts the electrons which strike the phosphor coating in the VFD causing it to glow. The applied positive voltage to cause illumination is +5 V; the segments are at -21 V when they are extinguished.

The microprocessor U1 controls all of the multiplexing of the lines to the VFD and therefore which segments illuminate at any given instant. Q1, Q2, Q3, Q4 and Q7 are buffer drivers. The illumination of each particular part of the display is controlled by a "grid" line and a "segment" line. The display is divided into 11 grids, grids 1 to 10 being the characters of the 10-character display (starting at the right-hand side) and grid 11 being the rest of the display, as shown in the diagram at the bottom of the page. Each grid is then divided into 35 segments, as shown in the separate diagram of a single character. Each part (generally each word) of grid 11 is a segment.

If you notice a fault in the display, the diagrams allow you to see which grid or segment is affected and therefore which of the tracks on the display PCB should be checked for breaks or shorts. The table (right) cross-references the grid and segment numbers with the pins on the VFD and on U1. There is also a self test sequence for the VFD.

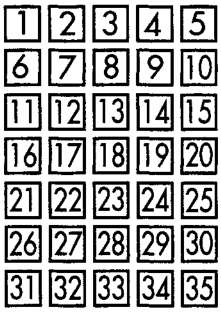
Self Test

To start the test, display the Main Menu then quickly press F, 6, STORE.

The display then illuminates in the following sequence:

- the words "SELF TEST" are displayed;
- the software number of the front panel microprocessor (U1) is displayed;
- all the grids and segments are illuminated simultaneously;
- each segment is displayed in turn in the form of the word "SEG" followed by a number, alongside which a dot illuminates for each segment in turn (as in the diagram below);
- each grid illuminates in turn;
- the words "ROTARY 00" are displayed, at which point you should turn the front panel dial, first in one direction and then in the opposite direction (positive or negative numbers are displayed after the word "ROTARY" to indicate correct operation);
- the word "PRESS SW10" is displayed, at which point you should press the VOLUME switch (SW1) several times to check it is operating correctly (sequential numbers after the "1" on the display indicate this);
- the preceding step is repeated for each front panel switch in turn (i.e. SW2 is STANDBY, SW3 is PROGRAMME SELECTOR and SW4 is SURROUND SOUND) and for each you should press the appropriate switch several times to test it.

At the end of this test sequence the message "TEST END" is displayed and the self test keeps repeating until you press the NORM key to return to normal viewing mode.



1	2	3	4	5
6	7	8	9	10
11	12	13	14	15
16	17	18	19	20
21	22	23	24	25
26	27	28	29	30
31	32	33	34	35

Segment numbers for grids 1 to 10

Grid No.	VFD Pin	U1 Pin
1	4	47
2	5	36
3	6	37
4	7	38
5	8	39
6	9	56
7	10	64
8	11	1
9	12	2
10	13	3
11	14	7

Seg. No.	VFD Pin	U1 Pin
1	28	16
2	29	17
3	30	18
4	27	19
5	26	20
6	25	21
7	24	22
8	23	23
9	22	48
10	21	49
11	20	50
12	19	51
13	18	52
14	17	53
15	16	54
16	15	55
17	31	24
18	32	25
19	33	26
20	34	27
21	35	28
22	36	29
23	37	30
24	38	31
25	39	32
26	40	33
27	41	34
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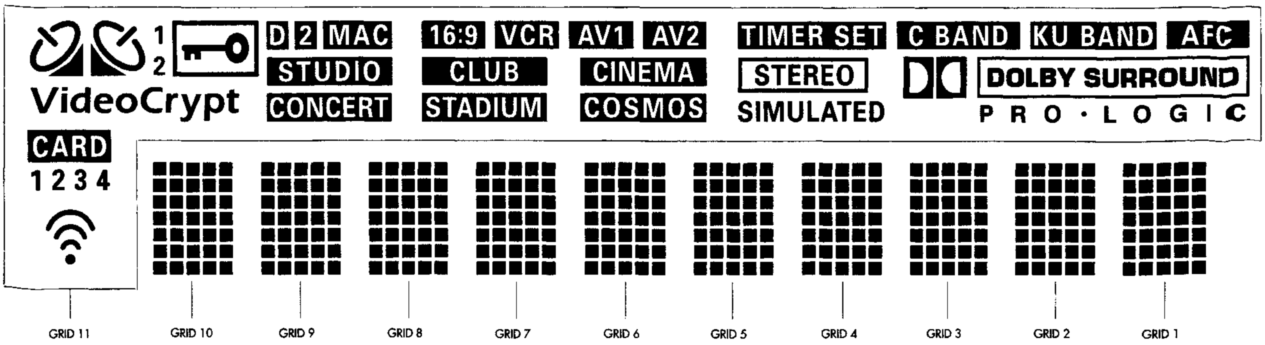
29	43	40
30	44	41
31	45	42
32	46	43
33	47	44
34	48	45
35, 36	49	46



U22 Extension PCB†

The main component in the control circuitry is U22 which is based on the Z8 microprocessor. In some receivers U22 is a custom-masked single component, but in some receivers it could be a small extension board containing a standard microprocessor and a separate ROM. This extension board contains six capacitors (C1, C2, C3, C4, C5 and C6), three ICs (U1, U3 and U4) and 16 MHz crystal X1. The circuit and component ident diagrams for this board are given adjacent; a parts list is given at the end of this manual. Note that the C3, C4, C5, C6, U1, U3 and U4 in this list are quite different from the components with those names which are on the main PCB. When the extension board is replaced by the custom-masked U22, X1 is moved to the main PCB as X3, C5 is moved to become C150 and C6 is moved to become C151.

U22 Functionality

U22 runs with a 16 MHz clock generated by crystal X3 and performs the following functions:

- it decodes the information received from U1, the microprocessor on the display board, (U1 has already processed data from the handset and from the front panel buttons or dial);
- it generates the control signals for the on-screen graphics;
- it controls the frequency synthesiser loops for the tuner and for the UHF modulator;
- it controls the routing of the video and audio signals;
- it controls other switching functions such as the LNB supply switching;
- in conjunction with U1 on the display board, it activates the front panel vacuum fluorescent display.

U27 is an E^{2}PROM which is used to store information which is set at the on-screen menus as well as preset and custom channel and frequency information. U25 is a shift register which acts as a port expander for U22.

Control Lines

A block diagram of the I^{2}C control lines is shown adjacent. Some of U22's control functions occur via the DATA line; others have specific control lines which are described at the relevant points in the circuit descriptions. Some lines (e.g. STATION_ID, LNB_SHORT) are inputs to U22 to inform it of conditions arising in the hardware. The lines AUXSTAT and DEC_STAT are inputs which inform U22 that pin 8 of the AV1 (AUX) SCART and AV2 (DEC) SCART respectively have gone high. As described on page 17, the line VCRSTAT can be an input or an output at U22 and it is this which controls pin 8 of the TV SCART. The TVSTAT line is always an output from U22 and is described on page 16.

Sometimes control lines arise in other parts of the circuitry, examples are NOISE_SEL line from pin 5 of U18 in the audio circuitry (see page 27) and the various MUTE lines in the sound board circuitry (see page 29).

Reset

Whe the receiver is powered on, a reset is applied to all the microprocessors within the unit (i.e. U22, U18, U1 on the display board, U5 and U8 in the VideoCrypt† circuitry), a reset also occurs when the +5 V supply falls to approx. 4 V. Transistor Q110, which is only just turned on at the full 5 V, switches off when the supply is less than 4 V. This switches Q111 on which shorts out the reset capacitor C594 and applies the reset to the microprocessors. If the reset line (RST) is low Q115 and Q114 also switch off; this removes the VPP voltage from the card reader board.

† Note: In receivers without VideoCrypt circuitry U22 has different functions.

- the menu software is changed to incorporate two languages (English/German);
- there is no software for controlling the VideoCrypt or card reader circuitry.

Refer to the dish positioner section in this manual for an explanation of the extra functions of U22 if a dish positioner is fitted.

AUDIO PROCESSING (MAIN BOARD)

Please see the main circuit diagram and the adjacent audio block diagram.

Demodulation, De-emphasis and Panda Noise Reduction

All of these functions are carried out by the audio processor IC U18. A band pass filter of frequency range 5 - 9 MHz (comprising Q104 and associated components) filters the baseband signal from pin 13 of the tuner. The filtered signal then enters the audio processor U18 at pin 58 and is digitised. All functions are then carried out digitally within the chip, under the control of the main microprocessor U22. The audio processor has two independent digital oscillators to tune the audio subcarriers independently.

SCART Input Selection

U18, in association with part of the switch U20, routes the audio signals which enter the receiver at the SCART connectors. They are also routed through to the sound board (where fitted) so that home cinema effects can be applied to them. The VCR and AV2 (DEC) audio inputs go directly to the audio processor and are digitised for input pre-processing. The AV1 (AUX) and TV inputs go through the switch U20 before being digitised by U18. The switch is controlled by the line AV/AUDIO from pin 13 of port expander U25. These incoming signals are digitised so that volume, treble and bass adjustments can be carried out on them.

There is also a 7 line path which routes the incoming signals from the SCARTs (and the input at pin 55 of U18 - see below) directly through U18 if they require no adjustment. Note that the audio signal from the tuner is always routed through U18 via the digital path.

The following are input decoupling capacitors: C143 and C144 (for AV2 (DEC) SCART), C139 and C140 (for AV1 (AUX) SCART), C141 and C142 (for TV SCART) and C132 and C133 (for VCR SCART). The capacitor ends connected to U18 should have a DC bias of approx. 3.8 V.

Input from Sound Board

There is an input to U18 at pin 55 which comes from the sound board (if fitted) via PL1 pin 6 and decoupling capacitor C601. This is the path for the centre channel for all speaker configurations except Configuration 4 (when it is the sum of the right total R_T and left total L_T channels). For Configuration 2 the **centre** channel emerges from U18 at pins 33 and 34 to be routed to the UHF modulator. For Configuration 4 the **sum** of R_T and L_T emerges at both pins. For Configurations 1 and 3 R_T emerges at 33 and L_T at 34, but note that in this case R_T and L_T have not been routed via the sound board. See also page 26.

Audio Processor - Peripheral Components and Control Lines

Audio processor U18 needs various peripheral components to function correctly:

- X2, C113 and C114 (on pins 62 and 63) form the crystal oscillator circuit which runs at 18.432 MHz;
- C115, C116 (on pins 43 and 44) are filter capacitors for the SCART A/D;
- C117, C118 (on pin 42) are filter capacitors for the internal analogue voltage reference;
- C111, C112 (on pin 54) are filter capacitors for the audio baseband A/D;
- C122, C123 (on pins 40 and 38) are filter capacitors for the volume control D/A and for the AV D/A;
- C120, C121 (on pins 31 and 32) are filter capacitors for the SCART D/A;
- filter capacitors for the power supplies as follows: C108 (from +5 V analogue on pin 57 via L22), C119 and C252 (+8 V on pin 39 to 41), C147 and C148 (+5 V digital on pin 18 to 19), C253 (+5 V digital on pin 6 to 7);
- D38 and R210 form a voltage regulator to convert +12 V to 8 V at pin 39.

Control/bus links to/from the audio processor are:

- pin 9 is the I²C bus clock to pin 10 of the main control microprocessor U22;
- pin 10 is the I²C bus data which connects to pin 37 of U22;
- pin 5 controls the noise sequencing selection for the Dolby Pro Logic Decoder (U4 on the sound board) if fitted;
- pin 4 can disable the switch U30 to mute the audio signal to the TV SCART.

Audio Baseband Processing and Signal Routing

The digital field processor in U18 and the op. amp. U19 process all the audio baseband signals and perform signal routing with the aid of U30 and U20.

Digital Signal Processing comprises:

- input pre-processing;
- audio mode selection (Stereo A, B, C or D, Mono 1 to 9, or customised mode, as selected at the Audio Menu);
- audio mode post-processing.

All of the above processing changes depend on a combination of the following:

- the speaker configuration set at the Speaker Configuration Menu (see also the later section entitled "TV SCART Output"), MSS 1000 series receivers only;
- the operation of the TV/SAT key (for switching between satellite, terrestrial and VCR - pin 8 of TV SCART and pin 29 of VCR SCART);
- the activity of the DEC status (pin 8 of SK3 = pin 8 of AV2 SCART) and the AV1 (AUX) status (pin 29 of SK3 = pin 8 of AV1 SCART) (can be controlled by the 0 (AV) key for switching between AV1, AV2 and satellite).

Dolby Pro Logic Input (MSS 1000 series receivers only)

The audio input to the Dolby Pro Logic Decoder (U4 on the sound board) can be any of the following:-

- FM SAT (frequency modulated satellite signal - i.e. analogue audio as in PAL, SECAM etc.);
- VCR (audio from VCR - i.e. when "VCR Play" or "VCR ➔ AV" is displayed on the receiver's front panel);
- TV (audio from terrestrial TV - i.e. when "TV ➔ AV" is on the front panel display);
- AUX (AV1) (audio from equipment connected to the AV1 SCART - i.e. when "AV1" is displayed on the front panel);
- DEC (AV2) (audio from equipment connected to the AV2 SCART - i.e. when "AV2" is displayed on the front panel).

These signals emerge from pins 28 and 29 of U18 and are then amplified before going to the Dolby Pro Logic Decoder (via ribbon cable between connectors PL4 on the main board and PL2 on the sound board) and to the TV SCART (via switch U30). The amplifiers have a gain of 1.5 and consist of U19 (A & D), R640, R641, R643, R644. Capacitors C507, C509 and resistors R642, R639 couple the signals from the audio processor U18 to the amplifier U19 (A & D). The low pass filter comprising C213 and C214, reduces any residual digital noise.

AV1/AV2 SCART Audio Outputs

The audio source for the AV1/AV2 SCART outputs is always FM SAT (L_T and R_T). Note that the AV1 (AUX) and AV2 (DEC) SCARTS are auxiliary inputs and decoder outputs. They can be used as audio and video inputs, but only baseband video output, so if you attach a VCR to these SCARTs you could not record the satellite video.

Components C145, R398 (for right channel) and C146, R399 (for left channel) couple the signals from pins 25 and 26 respectively of the audio processor U18 to the AUX (AV1) and DEC (AV2) SCART connectors.

VCR SCART Audio Output

The audio source for the VCR SCART output can be any one of the following:

- FM SAT (L_T and R_T)
- AUX (AV1) (L_T and R_T)
- DEC (AV2) (L_T and R_T)

C134, R396 (for right channel) and C135, R397 (for left) couple the signals from pins 36 and 37 respectively of the audio processor U18 to the VCR SCART.

UHF Audio Output

The audio source for the UHF output can be either:

- FM SAT (L_T and R_T), or
- the centre channel of any of the audio sources that go to the Dolby Pro Logic Decoder (see also the earlier section entitled "Input from Sound Board").

The selection of Configuration 2 (only applies to MSS 1000 series receivers) at the Speaker Configuration Menu causes the centre channel from the sound board to emerge from pins 33 and 34 of U18; this has implications for recording on a UHF-connected VCR (see the table below). For Configurations 1 and 3, R_T and L_T from the digital field processor in U18 emerge at pins 33 and 34 respectively.

When the receiver is in Configuration 4 (i.e. you cannot apply home cinema effects) the audio still needs to be routed via the sound board to reach the UHF modulator. In Configuration 4, R_T and L_T at pins 28 and 29 of U18 pass to U4 on the sound board where they are added together and put onto the path which (for the other configurations) is used by the centre channel. In this configuration the left, right and surround channels are muted and the "$R_T + L_T$" channel is set to a preset volume. The volume is therefore controlled by U18 (i.e. you can use the receiver handset to change the "UHF" volume). $R_T + L_T$ passes back to the main board via PL1 to enter U18 at pin 55. $R_T + L_T$ emerges at both pin 33 and pin 34.

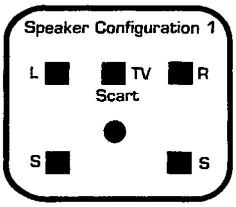
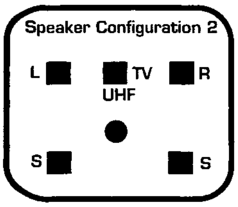
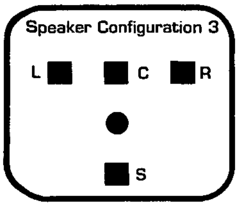
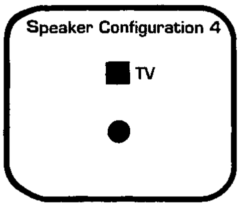
In all configurations the signals emerging at pins 33 and 34 are combined and pre-emphasised by U19C and associated components to give a mono signal.

TV SCART Audio Output

The signal routing to the TV SCART connector is performed by U30. Any of the following audio sources can be routed to the TV SCART:

- FM SAT
- VCR
- TV
- AUX (AV1)
- DEC (AV2)

The actual signals derived from these sources depend on the configuration set at the Speaker Configuration Menu (i.e. is controlled by the SPEAKER_SEL line from pin 24 of microprocessor U22). U30 is a 4053 switch; see also page 15.

Configuration **(MSS 1000 series only)**	**Audio to TV SCART**	**Audio to UHF**	**Comments**
	Centre channel from Dolby Pro Logic Decoder	Left total (L_T) and right total (R_T) directly from the audio processor U18.	To get audio (L_T and R_T) to a UHF splitter or to a UHF-connected VCR, **and at the same time** to hear the effects properly on the TV, (i.e. centre channel from TV), this configuration must be used, and the TV must also be connected by a SCART lead.
	Centre channel from Dolby Pro Logic Decoder	Centre channel from Dolby Pro Logic Decoder	
	Muted (the switch U30 is disabled in this case, under control from pin 4 of U18)	Left total (L_T) and right total (R_T) directly from the audio processor U18.	Because U30 is disabled, no **video** signals from a SCART-connected VCR can reach the TV, if the TV is UHF-connected (there is a by-pass to allow satellite video signals to reach the TV). Note that audio from the VCR can still be heard. See also page 17.
	Left total (L_T) and right total (R_T) from the audio processor U18, via U30. (Volume, bass and treble are also controlled from U18 in this case).	Left total (L_T) and right total (R_T) from the audio processor U18, passed via the sound board, as described near the top of this page.	

AUDIO PROCESSING (SOUND BOARD, IN MSS 1000 SERIES ONLY)

Please see the circuit diagram for the sound board and the audio block diagram on page 24. Details of sound board operation when the receiver is in Speaker Configuration 4 are given near the top of page 26.

Detection of the Sound Board

The main microprocessor U22 detects the presence of the sound board by communicating with the volume control ICs U6 and U9 via the audio I^2C BUS on pins 11 and 12 of U6 and U9. This communication is via a ribbon cable between PL3 on the main board and PL3 on the sound board. If this link is broken or if U6 and U9 are not powered or not functioning, then the main microprocessor will not detect them and you cannot access the Surround Menu and its sub-menus.

Input to the Sound Processor

The sound processor U4 performs Dolby Pro Logic decoding and digital sound processing (sound field simulation). The left total and right total signals are routed from the audio-processor U18 (on the main board) via a ribbon cable between PL4 on the main board and PL2 on the sound board. On the sound board they are routed via switch U2A (for the left channel) and U2B (for the right channel).

The signals are then split into two paths as follows.

- The signal to be applied to the analogue inputs is routed directly into the sound processor at pins 18 and 17 after being AC coupled by C18 then centred in the digitising window (see the sound processor section below) at approximately 2.5 volts by R64 (for right channel) and AC coupled by C19 then centred by R65 (for left channel). Input protection for the A/D converters inside U4 is provided by D6, R63 (for right) and D7, R66 (for left).
- The signal to be applied to the digital inputs is filtered by a 5th order low pass filter to prevent aliasing. The filter comprises U8A,C (for right) and U8B,D (for left) and associated components and has a bandwidth of 13 kHz. The audio signals are then centred in the digitising window by C26, R55 (for right) and C27, R57 (for left) and digitised at a sampling frequency of 44.1 kHz. D4, R56 (for right) and D5, R58 (for left) are input protection for the A/D converters inside the sound processor.

In the audio block diagram, the switch U2A and U2B is shown passing the left total and right total signals. This occurs when the noise control line (NOISE_SEL from pin 5 of the audio processor U18 on the main board) is high. If this control line is low, the noise sequencer feedback path is closed (which is the situation when the cyclic noise test at the Speaker Levels Menu is "on") - this is the condition shown in the sound board circuit diagram. See also the later section entitled "Noise Sequencer".

Sound Processor - Peripheral Components and Control Lines

The sound processor U4 has various necessary peripheral components:

- X1, R2, C3 and C4 (on pins 55, 56) form an 11.2896 MHz oscillator circuit;
- R4, C5, C6 and D8 (on pin 60) form the reset circuit which should be approximately 5 V during normal operation; R82 and Q11 reset U4 from Q6, D2 and associated components.
- U3 is a 32K by 8 pseudo-static RAM which stores the digitised audio signals and enables U4 to create the sound field simulation (for the "simulated" sound mode), time delay (as required at the Listening Position Menu) and the noise sequencer (as required at the Speaker Levels Menu);
- filter capacitors for the power supplies as follows: C121 (+5 V digital on pins 2, 3, 57, 58), C1, C56 (+5 V digital on pin 26), C120 (+5 V analogue on pin 4) and C2, C58 (+5 V analogue on pin 25);

The sound processor, in association with buffer U1B, generates two internal voltages both of which are approximately half the 5 V supply voltage:

- the centre voltage (CV) on pin 13 for the digitising window;
- the reference voltage (VREF) on pin 16.

Control/bus links to/from the sound processor are:

- a data bus and an address bus between the RAM U3 and U4 (pins 27 to 34 for data and pins 35 to 54 for address);
- a communication link from the microprocessor U22 on the main board is via a three wire bus on pins 1, 63 and 64 of U4.

Output from the Sound Processor

There are two output paths for the audio signals:

- an analogue path for the left, right and centre signals;
- a digital path for the surround and right and left simulated component signals.

The analogue signals are buffered by the operational amplifiers U1D (for right), U1C (for left) and U1A (for centre) and associated components. The outputs of these operational amplifiers should have a DC component equal to the reference voltage VREF (see also Oscillogram 15). The signals then have this DC component removed by C31, C51, C54.

The left and right signals are then fed to the summing amplifiers U5B and U5D respectively. The centre channel goes through a bass splitting filter which is a simple cross-over filter of frequency 100 Hz comprising U5A, U5C and associated components. This filter removes the centre channel's bass frequency which is then added to the left and right channels 3dB lower in level at the summing amplifiers U5B and U5D. The hardware allows U5C (the bass splitting filter) to be turned off by means of switches U10C, U10D and associated components. There is, however, no software facility to do this at present, so U10D is always closed and U10C is always open. The centre channel from U5C is routed to pin 19 of the volume control IC U9 via the coupling capacitor C109.

After the digitally processed signals have undergone D/A conversion in U4, they emerge at pins 11 (right simulated), 6 (left simulated) and 12 (surround) and are buffered by the hold capacitors C37, C38, C39 and the op amps U7A, U7C, U7B respectively. The signals are then low pass filtered and buffered as follows:

- filter C35, C36 and associated resistors then buffer Q1 for right simulated;
- filter C24, C23 and associated resistors then buffer Q2 for left simulated;
- filter C21, C20 and associated resistors then buffer U7D for surround.

The surround signal passes directly into the volume control IC U9 at pin 2. The right and left simulated signals are switched via U10B and U10A respectively to the summing amplifiers U5D and U5B which add the following signals together to create the combined left and right channels:

- the left and right signals from the sound processor;
- the bass from the centre channel;
- the right and left simulated components.

The combined left and right channels then pass to the volume control IC U6 (pins 19, 2) via C96 and C33 respectively.

Noise Sequencer

The sound processor U4 has an integral noise sequencer which tests the operation of the Dolby Pro Logic decoder and also allows you to set the speaker volume levels. The microprocessor U22 on the main board commands the sound processor (via the I^{2}C serial data bus) to generate the noise sequence.

The noise signals are generated using the digital outputs normally used for the right and left simulated components (i.e. pins 11 and 6 respectively of U4). They are then routed back into the processor via the switches U2A and U2B. In noise sequencer mode, the switch command line goes low to close the feedback path enabling the noise to enter the sound processor. The command line (NOISE_SEL) for the switches U2A and U2B comes from pin 5 of the audio processor U18 (main board). This command line also opens switches U10A and U10B, which prevents the noise signals being added to the left and right channels. The noise signal is then routed to each of the channels under the control of microprocessor U22 which alters the amplitude and phase of the signals coming out of pins 6 and 11 (the left and right digital outputs respectively).

Master Volume, Speaker Level and Treble/Bass Control

U6 and U9 perform the master volume control, the speaker level adjustment and the treble/bass control. U6 and U9 have similar functions and their pins are identically annotated in the circuit diagram - the only differences are:

- U6 is used for left and right channels and U9 is used for centre and surround;
- although U6 and U9 have a common data line (DATA - from pin 37 of microprocessor U22), they have separate clock signals (SCL1SOUND from pin 20 of U22 for U6 and SCL2SOUND from pin 19 of U22 for U9).

The power supply to U6 and U9 is 8 volts; they generate a reference voltage internally at approximately half this voltage which appears at pin 20.

The inputs to the ICs are pins 2 and 19 and these pins should be at half the supply voltage. (See also Oscillogram 16). C17, C95 (on pins 1, 20 of U6) and C97, C106 (on pins 1, 20 of U9) are filter capacitors.

The bass and treble adjustments are made at the Sound Shape Menu and are achieved using the following external capacitors:

- C30, C91 (on pins 4, 17 of U6) and C98, C102 (on pins 4, 17 of U9) for bass control;
- C89, C94 (on pins 6, 15 of U6) and C101, C105 (on pins 6, 15 of U9) for treble control.

All adjustments of the master volume, bass and treble are commanded by the microprocessor U22 on the main board via the two audio I^2C communication links on pins 11, 12 of U6 and U9.

The audio signals are then coupled via separate outputs from U6 and U9 to the power amplifiers (U11A, U11B, U12A, U12B) and to the phono outputs (which are on the main board and are connected through a ribbon cable between PL1 on the main board and PL1 on the sound board). Because of the high gain of the power amplifiers, the signals on pins 8 and 13 of U6 and U9 (see also Oscillogram 17) are very much lower than the signals on pins 7 and 14.

C93, C86 (for U11) and C104, C100 (for U12) couple the signals to the power amplifiers. C103 (on the sound board) and C220, C211, C222, C223, C224 (on the main board) couple the signals to the phono outputs.

Power Amplifiers

The power amplifiers U11 and U12 have a gain of approximately 40 dB and have similar functions - the only difference is that U11 is used for the left and right channels and U12 is used for the centre and surround channels. They are mounted on a heatsink and have a power supply of approximately 33 V at pin 12. They generate a reference voltage internally at approximately half this voltage which appears at pin 4. The outputs of these power amplifiers (pins 11, 13) should have a DC component equal to this reference voltage (see also Oscillogram 18).

The components around U11 and U12 have the following functions:

- C66 (for U11) and C77 (for U12) on pin 4 filter the reference voltage;
- C67, C68 (for U11) and C78, C79 (for U12) on pins 2 and 7 filter the feedback signal;
- C71, R79, C69, R78 (for U11) and C82, R85, C80, R84 (for U12) on the outputs (pins 11 and 13) prevent oscillations;
- C72, C70 (for U11) and C83, C81 (for U12) on pins 11 and 13 are decoupling capacitors to the speakers;
- C73, C74 (for U11) and C84, C85 (for U12) on pin 12 are power supply filter capacitors.

Power amplifier U12 can amplify either the centre or the surround signal depending on the status of the switch U2C. This status depends on the speaker configuration set at the Speaker Configuration Menu (i.e. centre for Configuration 3 and surround for Configurations 1 and 2). It is controlled by pin 24 (the SPEAKER_SEL line) of the microprocessor U22 on the main board. D9, R83 and C124 ensure smooth switching when the power is removed.

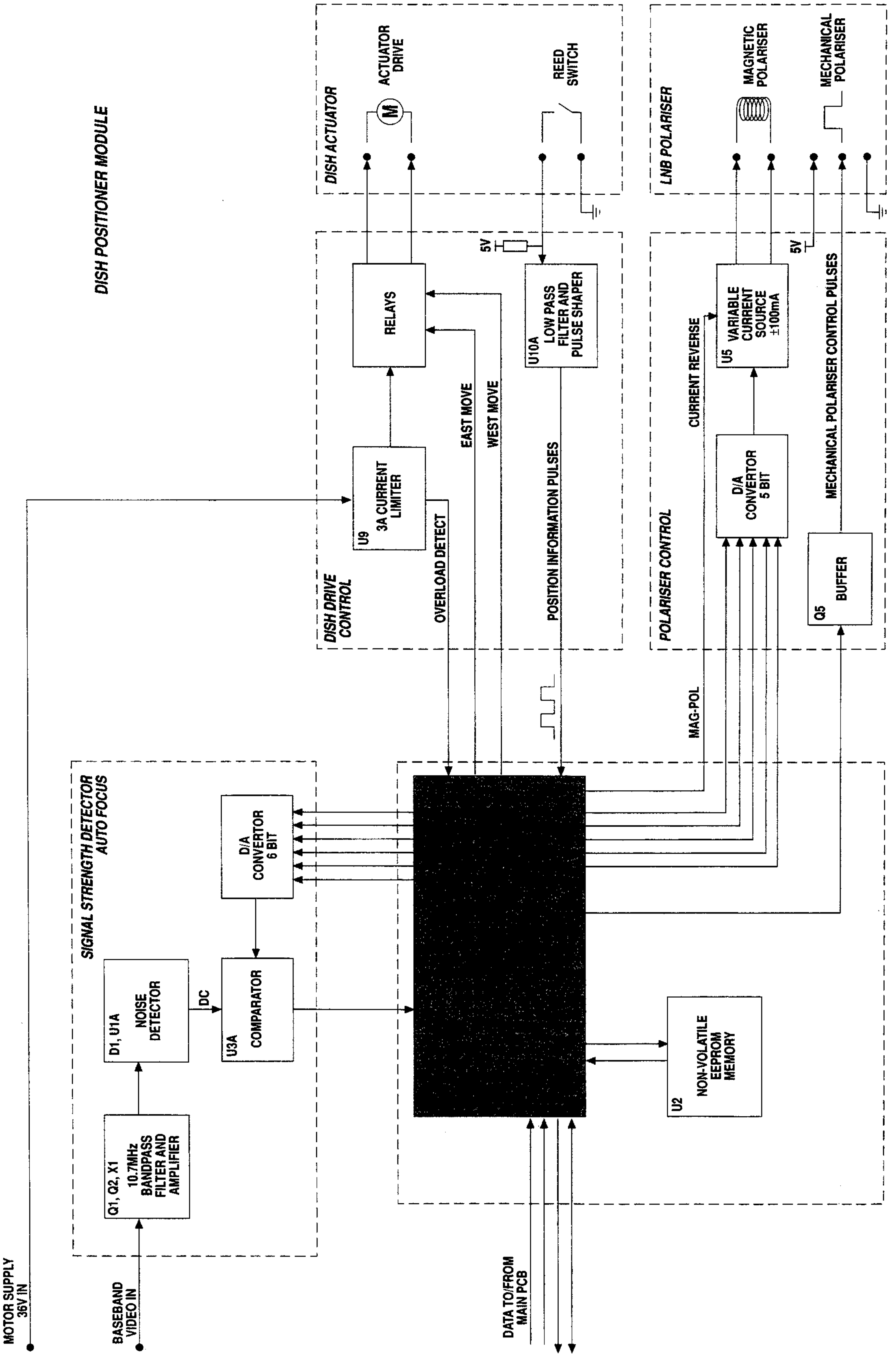
Speaker Mute and Anti Pop Circuit

Q3 and Q4 form a SCHMITT trigger circuit which monitors the 5 V D.C. power supply and activates when the mains power supply is turned off. Zener diodes D1 and D2 set the reference for the SCHMITT trigger. When the trigger activates, Q6 conducts which mutes the amplifiers to prevent a “pop” sound being heard. The line PWR-MUTE has to be high (i.e. at least 30 V) for the amplifiers to mute. In addition to this, transistors Q7, Q8, Q9, Q10 prevent the coupling capacitors (C86, C93, C100, C104) to the power amplifiers from discharging and creating a “pop” sound. R82 and Q11 reset the sound processor U4 during a power down, as mentioned earlier in the section entitled “Sound Processor - Peripheral Components and Control Lines”.

DISH POSITIONER – CIRCUIT DESCRIPTION

General

The dish positioner module comprises a single circuit board which is factory fitted to the receiver as an option. The board controls all aspects of dish movement and polarisation. It interfaces with the main PCB via PL11 (12 way ribbon) for control and annunciation data and also takes motor power from the main PCB (via PL5). A functional block diagram is shown below.


DISH POSITIONER MODULE
DISH ACTUATOR
M
ACTUATOR DRIVE
REED SWITCH
LNB POLARISER
MAGNETIC POLARISER
MECHANICAL POLARISER
5V
RELAYS
U10A LOW PASS FILTER AND PULSE SHAPER
5V
U5 VARIABLE CURRENT SOURCE ±100mA
CURRENT REVERSE
MECHANICAL POLARISER CONTROL PULSES
EAST MOVE
WEST MOVE
U9 3A CURRENT LIMITER
OVERLOAD DETECT
POSITION INFORMATION PULSES
DISH DRIVE CONTROL
D/A CONVERTOR 5 BIT
Q5 BUFFER
POLARISER CONTROL
MAG-POL
SIGNAL STRENGTH DETECTOR AUTO FOCUS
D/A CONVERTOR 6 BIT
D1, U1A NOISE DETECTOR
DC
U3A COMPARATOR
Q1, Q2, X1 10.7MHz BANDPASS FILTER AND AMPLIFIER
U2 NON-VOLATILE EEPROM MEMORY
MOTOR SUPPLY 36V IN
BASEBAND VIDEO IN
DATA TO/FROM MAIN PCB

DISH MOVEMENT CONTROL

Microprocessor

All user commands for dish movement control are received from the IR handset and decoded within the receiver's microprocessor U22 on the main PCB. Dish control data is then re-transmitted via the 4 wire bi-direction serial bus up to the positioner's microprocessor U4. All information relating to dish positioner status is displayed by the receiver using the on-screen graphics system and/or the front panel display.

The dish positioner system is centered around a Z8 microprocessor U4. This utilises an on-chip clock oscillator for which the 12 MHz crystal X2 is used. The system control software is stored within ROM which is an integral part of U4. The microprocessor is active at all times, including standby mode. All the user definable variables (E/W limits, satellite names and positions, current dish position etc.) are stored in the non-volatile EEPROM memory IC U2. The microprocessor communicates directly with the EEPROM U2 via a bi-direction data bus (pins 2 and 14 of U4).

Eleven of the output ports are utilised to provide two separate D/A converters. The 6 bit D/A is used to provide a variable reference voltage for the auto-focus system. The 5 bit D/A provides a variable control voltage for the magnetic polariser current source IC U5. The mechanical polariser control pulses are generated by the microprocessor and output on pin 17.

Power

The dish actuator motor power is 28-38 V dc (nominally 36 V, but is load dependent). This is provided by D54 and C216 in the main PCB switched mode power supply area. The power enters the positioner PCB at PL2, and on to regulator IC U9 which is configured in current limit mode. This provides three very important functions: short circuit current foldback protection (<1 A); thermal overload shutdown (150°C); and fast current limiting (3 A).

The latter of these is most important, not only for overload protection, but also to prevent the motor start up current demand from exceeding 3 A each time the dish actuator is moved. Without the limiter, some larger motors would cause the receiver's SMPS circuit to shut down each time the motor was started. Q8, D10 and R66 form a sensing circuit to detect any of the overload shutdown conditions previously described. If the in/out differential on U9 exceeds approximately 6 V, then Q8 conducts thus pulling pin 12 of the microprocessor U4 high. If this overload condition persists, the relays will be switched off to remove the overload and an OSG warning message will appear at the TV. Transient overloads will occur each time the motor starts up, these are ignored by the software.

Motor relays and suppression

Diodes D8, D9, D11 and D12 protect the regulator against spikes, motor back-emf etc. The output of the regulator is switched by two SPDT relays to provide motor voltage reversal RL1 (west) and RL2 (east). When both relays are "off", the configuration of the contacts applies a direct short to the motor terminals in order to provide dynamic braking to the actuator motor. This minimises any over run when a dish movement ends.

All relays have some contact bounce which can cause large voltage fast transients whilst switching an inductive load. The amplitude of these transients is clipped by two diodes connected from each motor terminal to supply and ground (D17/D18 and D19/20). The snubber network R67 and C49 absorbs motor back emf and helps to minimise any arcing of the relay contacts. Capacitors C41, C42, C43, C44, C50, C51 and C56 provide RF filtering to all the dish connections on SK1.

Position feedback

The movement of the dish is monitored by counting the pulses sent by the pulse generator in the actuator unit (reed switch or photo interrupter types). The signal entering the positioner unit via SK1 pin 3 will often contain contact bounce and other unwanted transients. These are removed by the clipping diodes D15 , D16 and the low pass filter comprising R79 and C55. The resulting integrated signal is then squared off by IC U10A which is configured as a mid point biased comparator, thus providing a clean square wave signal to the count input of the microprocessor U4, via buffer Q9. Protection against accidental connection of 36 V motor power to the pulse input is provided by R79, D15 and D16.

Power fail protection

Should the mains power be lost whilst the dish is moving, the current position of the dish when it stops is not lost. This is achieved by the relatively slow discharge time of C35 which provides power to U2, U4 and U10 for around 2 seconds after the power fails. During this time, the actuator motor is stopped, and the dish position count is stored into the non-volatile EEPROM memory U2. When power is restored, normal operation of the positioner may resume.

AUTO FOCUS SYSTEM

This feature enables the positioner to automatically search within a pre set dish movement range, whilst simultaneously detecting the received signal strength. The position of strongest signal is memorised, so that after completion of the search, the dish can return to the peak signal position.

Signal strength detector

Signal strength measurement is not obtained by detecting the satellite RF signal, instead, the out-of-band noise present in the tuner baseband video signal is used. This noise is a product of the LNB and tuner/demodulator system, and its amplitude is large when the satellite signal is weak and vice versa. This system also provides information for the signal bargraph displays used within the OSG menus and on the receiver front panel.

The tuner baseband output arrives at PL1, is amplified by gain stages Q1 and Q2. A 10.7 MHz ceramic bandpass filter X1 forms the coupling between the two gain stages, and this removes the unwanted video signal and the audio subcarriers leaving behind a noise envelope approximately 150 kHz wide centred on 10.7 MHz. Diode D1 and IC U1A form a temperature compensated RF amplitude detector. A voltage which is directly proportional to the strength of the received signal appears at U1A pin 1.

This signal voltage is processed by a 6 bit successive approximation A/D converter consisting of U3A and the microprocessor U4. The signal voltage is compared by U3A comparator with the output of software driven D/A converter (microprocessor pins 4, 5, 19, 20, 21, 23). Whilst the AF system, or the signal bargraph is active, the D/A output is constantly ramped up and down by the software. The output of U3A (pin 1) goes to microprocessor input (pin 1). This line will toggle when the D/A ramp level is equal to the detected signal voltage and this enables the software to detect the received signal strength from the satellite dish.

POLARISER CONTROL

Mechanical polariser

Either electromagnetic or mechanical polarisers may be used. For the mechanical servo type of polariser, a variable width pulse signal is generated directly by software within the microprocessor U4. The range is 0.8 ms to 2.2 ms depending upon the polarity skew value set up within the menu system of the receiver. These pulses are then buffered by Q5 and AC coupled by C39 before reaching the pulse output connector SK1 pin 5.

A power source with short circuit protection for the polariser servo is provided by U8 5 V regulator IC. R58, C39, R60 and D5 provide protection to the circuit should 36 V motor power be accidentally applied to the polariser output terminals due to incorrect motor wire connection.

Electromagnetic polariser

U5 provides a variable current source up to ±100 mA to energise an electromagnetic polariser coil. The polarity of the energising current is set by the microprocessor via U5 pin 5 and pin 6. When pin 15 of the microprocessor toggles from 0 to 5 V, the current output of U5 is reversed.

The magnitude of the energising current is controlled by the output voltage of U1B. The energising current returns to ground from pin 1 of U5 via R55. The voltage developed across this resistor is thus directly proportional to the current taken by the polariser coil. This voltage is compared with the control voltage provided by the software driven D/A converter (microprocessor pins 24 to 28). A constant current loop is thus produced, with the current value set by variables in the receiver OSG menu system.

Short circuit protection for the magnetic polariser output is provided by the 12 V/100 mA voltage regulator IC U6. In the event of either output terminal being shorted to ground, the regulator will limit the current to a safe value.

NOTE: Should the 36 volt actuator motor be accidentally connected between one of the motor terminals and one of the magnetic polariser terminals, damage is likely to occur when a dish move command is given. The design of this product cannot protect for this and care should be taken to prevent this occurrence.

DISH POSITIONER ERROR MESSAGES

Under certain conditions, a message may be displayed on screen indicating that an abnormal or unusual situation has arisen. These messages are explained here along below with suggested causes and remedies as appropriate:

LIMITS NOT SET	Before the dish positioner can be used to move the dish, the software limits must be defined and stored from within the Set Limits menu. If any attempt to move the dish is made from any other menu or operating mode before the limits have been defined this message will be displayed and dish movement will be prevented.
DISH AT LIMITS	This message is displayed whenever an attempt is made to move the dish beyond the position at which the East or West software limits have been set. The dish cannot be moved any further in that direction. It can however be moved in the opposite direction, away from the software limit position. In order to adjust the dish movement range, the software limits may be moved at any time by entering the Set Limits menu. Any previously stored satellite positions will automatically be recalculated if the limits are redefined.
POSITION OUTSIDE LIMITS	This message occurs if a programme is selected which has been allocated to a satellite position which is not within the range defined by the East and West software limits. The dish will not move from the present position and the message will be displayed. This situation can only occur if the user has re-defined one or both of the software limits in such a way that a previously stored satellite position is now outside the East/West limit range. The situation is corrected by resetting the software limit.
POSITION NOT SET	This message occurs whenever a programme is selected which is allocated to a satellite name which has not been set to a specific dish position. The position may easily be set from within the Set-up Programme menu, (see user guide for more information).
MOTOR ERROR	This message will occur whenever a dish move command is issued by the dish positioner, but for some reason no pulses are received back into the positioner reed input terminal. The possible causes of this condition are listed here: **a)** An attempt is made to move the dish beyond the hardware limit switch settings. Most types of actuator units have adjustable micro-switches for over-travel protection. The software East/West limits should be set within the range of the actuator hardware limit switches in order to prevent this message from appearing. **b)** An attempt is made to move the dish whilst the actuator motor circuit is disconnected. e.g. A motor wire may have become disconnected from the rear panel terminal, or at the dish end of the control cable. **c)** An attempt is made to move the dish whilst the pulse feedback reed circuit is inoperative. e.g. the reed switch wire may have become disconnected on the rear panel or at the dish end of the control cable. Alternatively, the reed switch itself may be damaged thus causing no feedback pulses to be transmitted back to the dish positioner. ***NOTE:*** *Any of the fault conditions described in c) will result in the dish being moved without the current position count register being updated, thus any previously stored satellite positions will appear to be incorrect, after the original fault has been rectified. The current position may be restored by following the recovery procedure on page 34.*

ERROR MESSAGES (CONT.)

MOTOR OVERLOAD

This message will occur if the 36 V dish actuator supply is overloaded or overheated. Once this message has appeared, the relays will be switched off immediately to remove the overload condition. Some possible causes of the overload condition occurring are described here:

a) An attempt is made to move the dish whilst a direct short is present across the motor output terminals. Also, if the actuator motor is stalled or seized, a virtual short will be present across the output terminals.

b) If the actuator motor power supply circuit becomes overheated, it will go into thermal shutdown mode which will cause the motor overload message to appear. Some possible reasons for this are:

- i) Use of a very large actuator motor which may take too much current from the dish positioner;
- ii) Restriction of the ventilation slots on the top or the base of the receiver;
- iii) Repetitive stop/start moving of the dish for an extended period of time causing the regulator to heat up, because the motor will not reach its normal rotational speed and therefore will draw an abnormally high current, thus heating the current regulator.

Any of the above, or a combination, may well be the cause of the problem. Once the receiver has been allowed to cool for a short while, normal operation can be resumed. However, the cause of the overheating should be identified and corrected.

RECOVERY PROCEDURE

If for any reason the current displayed satellite position counter should become out of step with the actual satellite position, follow this procedure to restore the position counter information:

1. Press MENU, then 4 to display the Set Up Programme menu.
2. Select a satellite that you have previously stored and adjust for best picture using ◄ and ► keys.
3. Press the F key twice to enable Auto Focus to lock in to the strongest signal from this satellite.
4. Press F then STORE. The position that you had previously stored for this satellite is loaded into the current position counter, you should now be able to find all the other preset satellites.

OSCILLOGRAMS FOR FAULT TRACING

The oscillograms which follow are divided into 5 main sections: Video, Audio, SMPS, Control and VideoCrypt (including some tests that can be performed on the card reader PCB). It is important that, within each of these sections, you check the presence of the signals in the order they are given (e.g. for the video circuitry test at points 1 to 11 in that order).

The oscillograms are numbered sequentially and the appropriate section and PCB is given above each. The oscillogram numbers are marked on the circuit diagrams and the PCB component ident diagrams. The oscillogram test points have been chosen to be on the more convenient side of each board (e.g. non-copper side of the main PCB, copper side of the sound PCB etc.). If possible, the other points where we suggest you make checks are also on these sides of the PCBs.

Alongside each oscillogram is a note of where the test point is, a brief description (including any special instructions) and notes on which components you need to check if your oscillogram is not like that shown.

NOTE: The horizontal and vertical scales of each oscillogram is shown at its right hand side; the 0 V point is shown at its left hand side. When the oscilloscope is DC coupled, 0 V appears at the bottom of the oscillogram; if it needs to be AC coupled this fact is mentioned in the text and 0 V is near the centre of the oscillogram.

Generally, if you suspect that an IC is not functioning, before you try to replace it you should check the following:

- that it is receiving its supply at the appropriate pin (if it is not being supplied, trace back the supply line to the PSU to find where there is a fault);
- that the IC is receiving instructions from the microprocessor U22 or port expander U25 via the control lines at the appropriate pins;
- that the receiver has been configured correctly at the appropriate menus (see the User Manual for details).

As stated at the top of page 37, there are several ICs within the VideoCrypt circuitry that you are not allowed to replace. If you suspect faults within the VideoCrypt circuitry, you must return the receiver to the Pace service centre.

Test Point 1: LK 182 (Main PCB)

Description: AC coupled oscilloscope

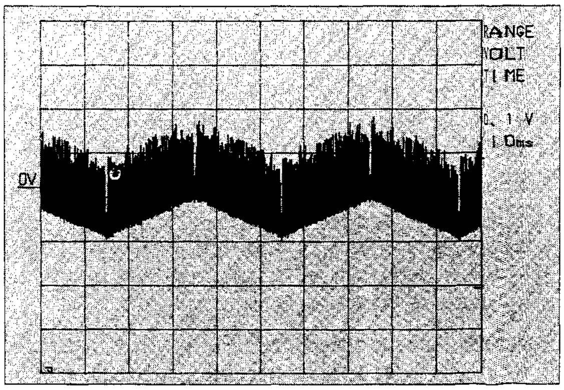
The trace shows tuner output (i.e. totally unfiltered video).

The signal may look noisier than the trace shown if the signal is weak or the dish antenna is small.

If the trace is not as shown, check:

- that the tuning voltage at TP77 changes when different programmes are selected;
- the prescaler output on pin 18 of TUNER1 (i.e. at LK207);
- the 4 MHz reference at pin 12 of U26;
- the LNB voltage on pin 5 or pin 3 of TUNER1 (depending on whether the current programme is from LNB 1 or LNB 2 respectively).

1. VIDEO MAIN PCB



Test Point 2: positive side of C501 (Main PCB)

Description: AC coupled oscilloscope

Traces 2A and 2B show the normal video signal at test point 2, only the time axis is different; there may be slight variations in the trace, depending on picture content.

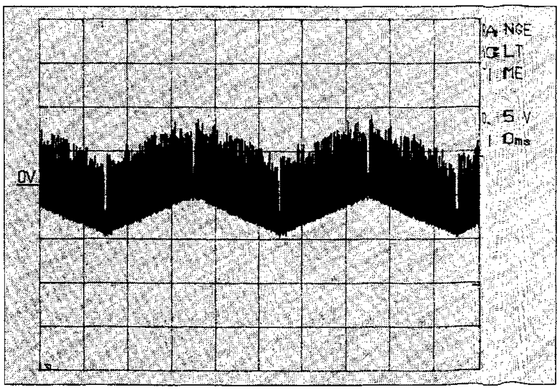
If the trace is not as shown, check:

- the route through U26, i.e. check back from pin 20 through to pin 3 of U26 to check that the trace is as shown. (Consult the circuit description for U26.)

Note that pin 3 of U26 is similar, in effect, to point 1 above.

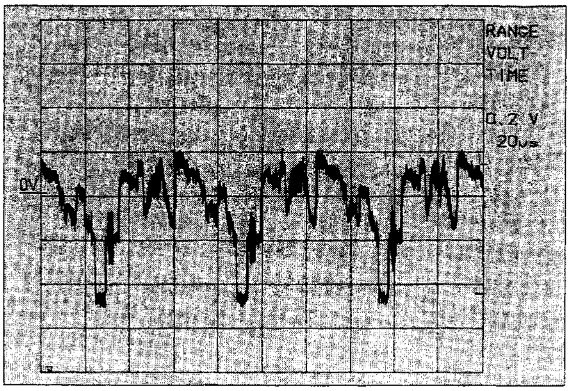
Note that pin 6 of U26 is similar, in effect, to point 1 above, but should give a trace of much larger amplitude (approx. 3 V p-p).

2A. VIDEO MAIN PCB

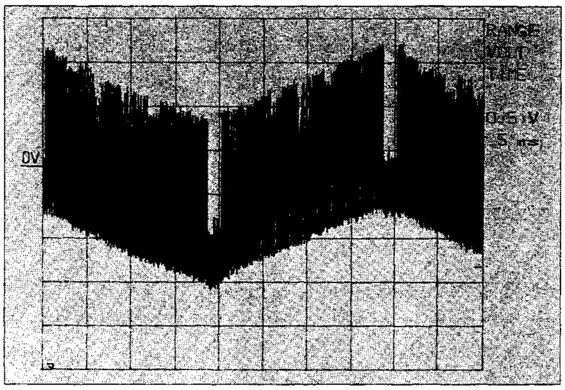


Test Point 2: positive side of C501 (Main PCB) (see previous Oscillogram 2A)

2B. VIDEO MAIN PCB



3. VIDEO MAIN PCB



Test Point 3: Junction of L18 and R336 (Main PCB)

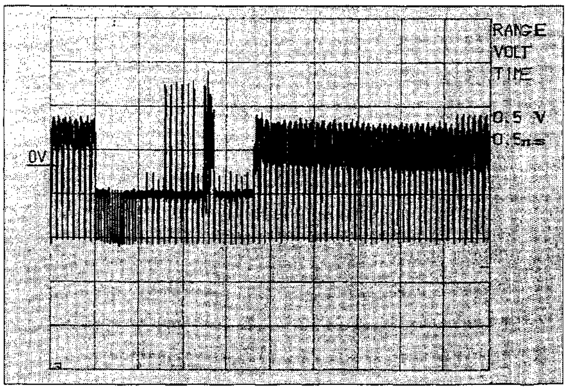
Description: AC coupled oscilloscope

The trace shows unclamped video of the correct gain. This is the video signal at one side of Q59 and C194, whereas Oscillogram 4, below, shows the signal at the other side.

If the trace is not as shown, check:

- Q53 and associated components;
- the gain stage (Q57, Q58).

4. VIDEO MAIN PCB



Test Point 4: Junction of L19 and R345 (Main PCB)

Description: AC coupled oscilloscope

The trace shows clamped video at the correct DC level of 2.6 V (black level). This is the video signal at the opposite side of Q59 and C194 (compared with Oscillogram 3).

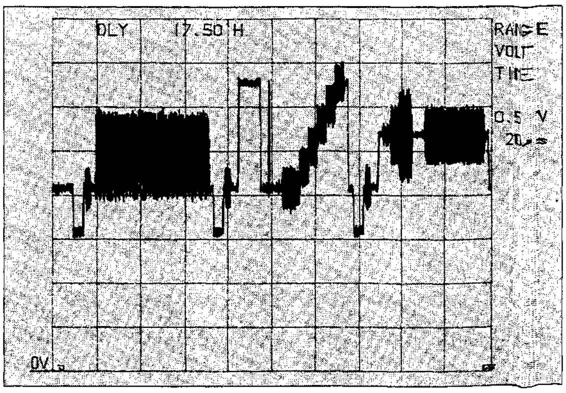
If the trace is not at the correct DC level, check:

- that the DC level at the base of Q99 (i.e. at the positive side of C198) is correct (2.6 V) - if it is, then Q99 and/or Q100 may be faulty; if it is not correct then there may be a problem in the VideoCrypt circuitry.

If the trace is not as shown, but looks like Oscillogram 3:

- Q59, Q99 and/or Q100 may be faulty.

5. VIDEO MAIN PCB



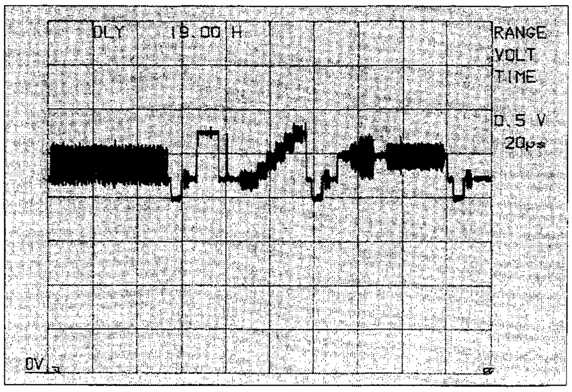
Test Point 5: LK151 (Main PCB)

Description: This trace also shows clamped video; its DC level is important - it should be approx. 2 V black level and approx. 1.85 V peak-peak (sync. to bar).

If the DC level is not correct, check:

- Q62, Q98, Q99 Q100 and their associated circuitry.

6A. VIDEO MAIN PCB



Test Point 6: Pin 12 of U7 (Main PCB)

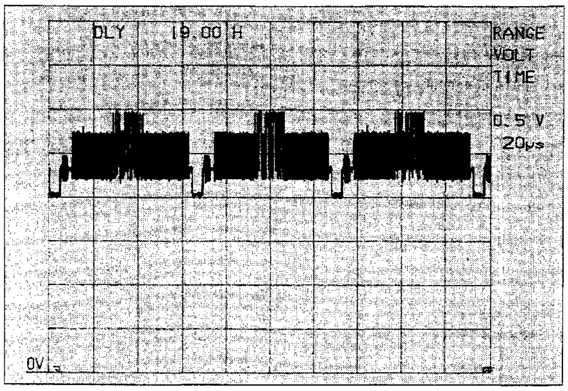
Description: Trace 6A shows the trace you would expect at test point 6 when there should be a picture on the screen; trace 6B (next oscillogram) shows what to expect at test point 6 if there is a plain coloured background with graphics on the screen.

Check for trace 6A. If this is as expected, remove the input and select a plain coloured screen with graphics (e.g. Main Menu) and look for trace 6B.

If the traces are not as shown, check:

- that the horizontal sync is being fed into pin 30 of U7 (see oscillogram 7);
- that the vertical sync is being fed into pin 31 of U7 (see oscillogram 8).

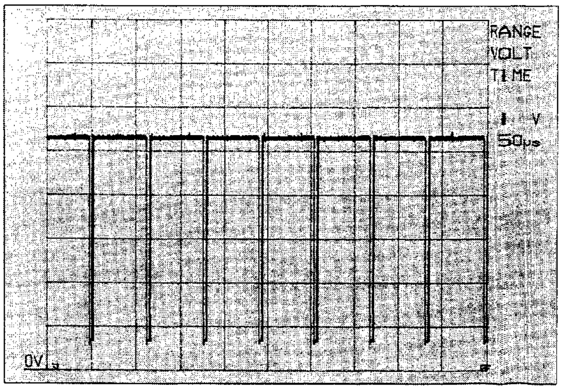
6B. VIDEO MAIN PCB



Test Point 6: Pin 12 of U7 (Main PCB) (see oscillogram 6A)

Description: Trace 6B shows what to expect at test point 6 if there is a plain coloured background with graphics on the screen. The graphics can be seen on the centre of the trace and, similarly, on the traces at either side of centre.

7. VIDEO MAIN PCB



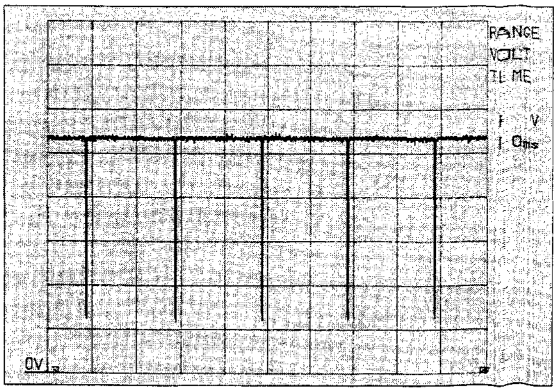
Test Point 7: Pin 30 of U7 (Main PCB)

Description: The trace shows the horizontal sync..

If the trace is not as shown, check:

- U29, Q65 and associated components in the sync. separator circuitry

8. VIDEO MAIN PCB



Test Point 8: Pin 31 of U7 (Main PCB)

Description: The trace shows the vertical sync..

If the trace is not as shown, check:

- U29 and associated components in the sync. separator circuitry

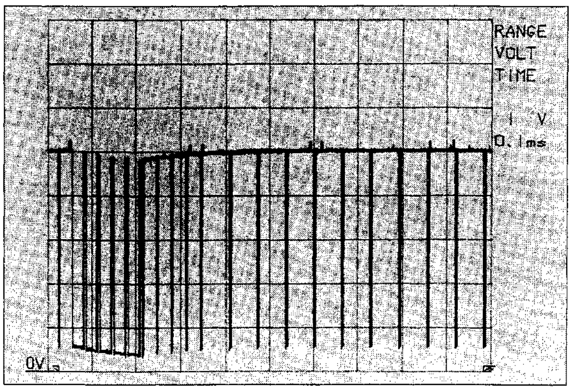
Test Point 9: LK69 which is the same as pin 27 of U7 (Main PCB)

Description: The trace shows the composite sync..

If the trace is not as shown, check:

- U7, X4 and associated circuitry

9. VIDEO MAIN PCB



Test Point 10: LK270 which is the same as pin 19 of SK2 (TV SCART) (Main PCB)

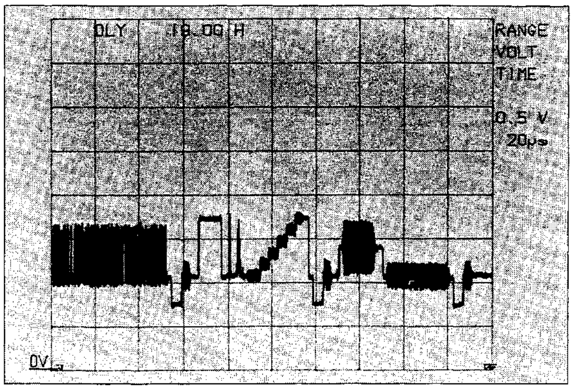
Description: The trace shows approx. 1 V peak-to-peak of clamped composite video (if the TV is connected to the SCART socket).

If the trace is not as shown or has the wrong amplitude, check:

- Q41, Q40 and associated circuitry.

Note that the video output to the TV SCART at test point 10 depends on the routing through switch U21 to pin 3 of U21. For the satellite video signal pin 4 should be connected to pin 3 (see the video circuit description on page 16).

10. VIDEO MAIN PCB



Test Point 11: Pin 40 of SK3 (AV1 AUX SCART) (Main PCB)

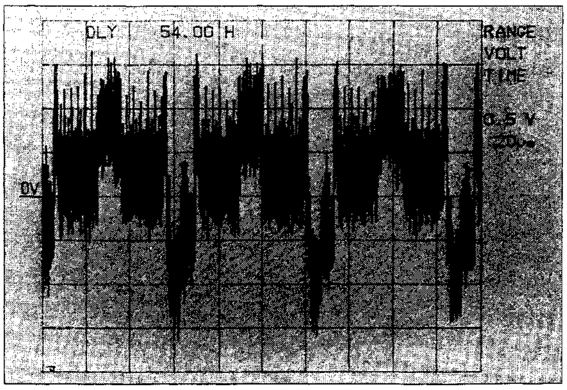
Description: AC coupled oscilloscope

The trace 11A is when PAL has been set at the "Decoder Output" option in the External AV Menu. It shows baseband video and should be approx. 2 V peak-to-peak. See also Oscillogram 11B below.

If the trace is not as shown or has the wrong amplitude, check:

- U26 and the route from pin 22 of U26 (Q54, Q55 and associated circuitry).

11 A. VIDEO MAIN PCB



Test Point 11: pin 40 of SK3 (AV1 AUX SCART) (Main PCB)

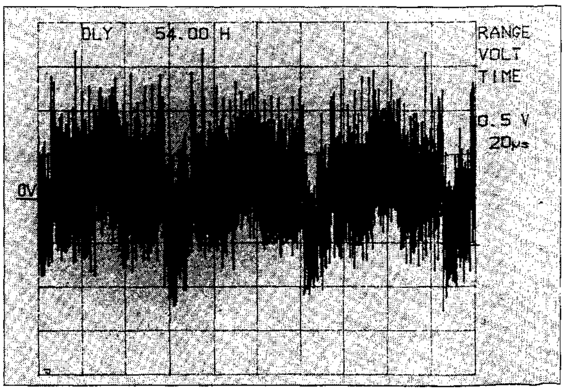
Description: AC coupled oscilloscope

The trace 11B is when MAC has been set at the "Decoder Output" option in the External AV Menu. It shows baseband video and should be approx. 1 V peak-to-peak. See also Oscillogram 11A above.

If the trace is not as shown or has the wrong amplitude, check:

- U26 and the route from pin 22 of U26 (Q54, Q55 and associated circuitry).

11 B. VIDEO MAIN PCB



Test Point 12: Pin 63 of U18 (Main PCB)

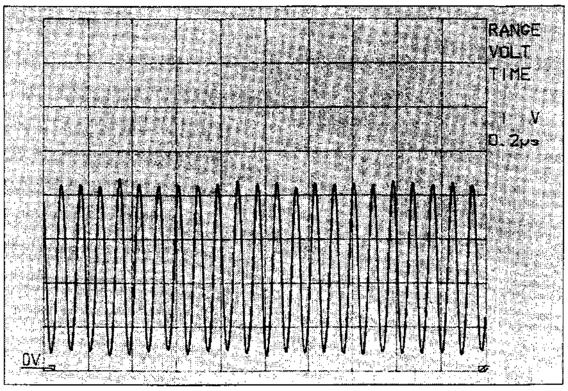
Description: The oscilloscope probe should be on x 10, otherwise it will load the crystal.

The trace shows the amplitude of the 18.432 MHz reference.

If the trace is not as shown, check:

- X2 and associated circuitry.

12. AUDIO MAIN PCB



Test Points 13: Pins 1, 7 and 14 of U19 (Main PCB MSS 1000 series receivers only)

Description: AC coupled oscilloscope

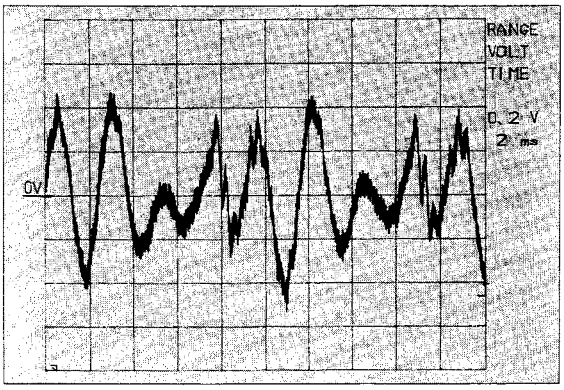
The trace should be similar at all three points. It shows the amplified audio signals for the right total channel (pin 7) and left total (pin 1) before they pass to the Sound PCB. At pin 14 the signal is the mono output to the UHF modulator (i.e. the left and right total channels combined and pre-emphasised by U19C) - but note that if the receiver is in Speaker Configuration 2, pin 14 is the centre channel from the Sound PCB, so in that case you need to ensure that your audio source programme has a centre channel (see also the notes at Test point 15 below).

The signal should be biased around 0 V, so ensure that the trace is produced with 0 V at the centre of the screen.

If the trace is not as shown, check:

- the components and circuitry back to and including U18.

13. AUDIO MAIN PCB



Test Point 14: Pin 56 of U4 (Sound PCB if fitted)

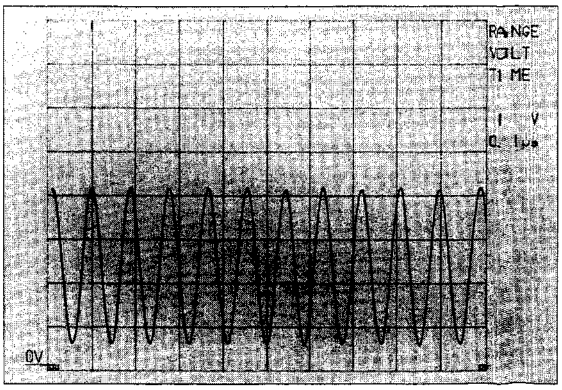
Description: The oscilloscope probe should be on x 10, otherwise it will load the crystal.

The trace shows the amplitude of the 11.2896 MHz reference.

If the trace is not as shown, check:

- X1 and associated circuitry.

14. AUDIO SOUND PCB



Test Points 15: pins 8, 9, 17, 18 of U4 (Sound PCB if fitted) for inputs pins 6, 11, 12, 19, 20, 21, 22, 23, 24 of U4 for outputs

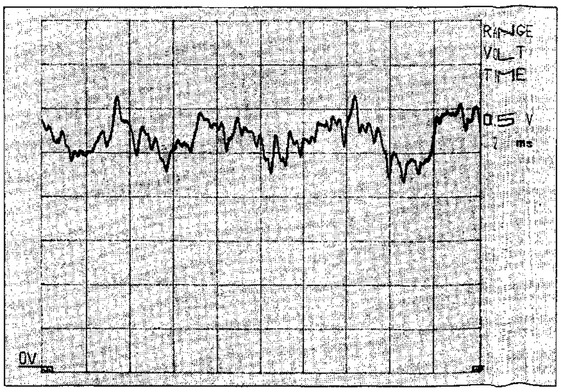
Description: The trace should look similar at all points, as the different points are the different audio channels. To be able to see traces at all points, the programme you use as an audio source must have all the audio channels (L, R, C and S) which will not be the case for old films (made without Dolby Stereo). For most of the test points, it is best to set the receiver to a music programme with "Simulated" sound mode and "None" effect; for pins 6 and 11 it is best to use the "Cosmos" effect.

Check that the audio signal is centred at approx. 2.5 V DC.

If it is not, check:

- U1B (pin 6 or 7) as this IC buffers the 2.5 V reference from pin 13 of U4 to pin 16 of U4.

15. AUDIO SOUND PCB



Test Points 16: pins 2 and 19 of U6 and U9 (Sound PCB if fitted) for inputs; pins 7 and 14 of U6 and U9 for outputs to phono sockets

Description: AC coupled oscilloscope

The trace should look similar at all points, as the different points are associated with the different audio channels (but note that the amplitude of the output signal depends on the volume setting for the appropriate channel). To be able to see traces at all points, the programme you are using as an audio source must have all the audio channels (L, R, C and S) which will not be the case for old films (made before the advent of Dolby Stereo). It is best to set the receiver to a music programme with "Simulated" sound mode and "None" effect.

Check that the audio signal is centred at approx. 4 V DC.

If it is not, check:

- U6 and U9 as they generate the 4 V reference at pin 20.

Test Points 17: pins 8 and 13 of U6 and U9 (Sound PCB if fitted) for outputs to power amplifiers

Description: AC coupled oscilloscope

The trace should look similar at all points, and similar to that shown in trace 16 above, except that the amplitude of the signal will be much smaller (once again the amplitude also depends on the volume setting for the appropriate channel). The notes given in the description above also apply.

Check that the audio signal is centred at approx. 4 V DC.

If it is not, check:

- U6 and U9 as they generate the 4 V reference at pin 20.

Test Points 18: pins 11 and 13 of U11 and U12 (Sound PCB if fitted) i.e. outputs from these power amplifiers

Description: AC coupled oscilloscope

The trace should look similar at all points, and have an amplitude much greater than that in Oscillogram 17 above. The notes given in the description of Oscillogram 16 above also apply in this case.

Check that the audio signal is centred at approx. 16 V DC.

If it is not, check:

- U11 and U12 as they generate the 16 V reference at pin 4.

WARNING: While you are making the following measurement, you and the oscilloscope must NOT be earthed. Do not touch any metal parts of the oscilloscope.

Test Point 19: End of R8 (i.e. same as U1, pin 6) (Main PCB)

Description: The frequency of the trace will vary with the input voltage and the PSU load.

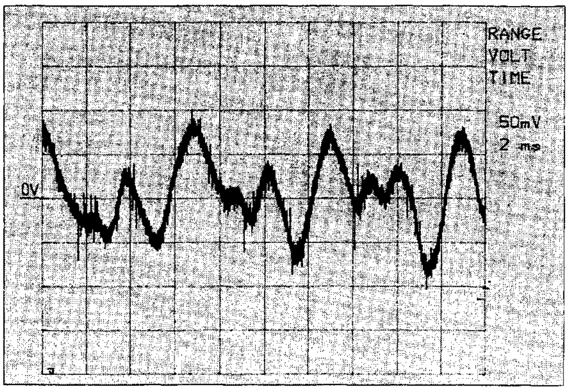
If trace is not as shown, TURN OFF THE PSU and check:

- the SMPS circuit; if fuse FS1 keeps blowing, check for shorts on any of the supply rails and that Q1 is not short-circuit; check the continuity of the loop from D12 to R13.

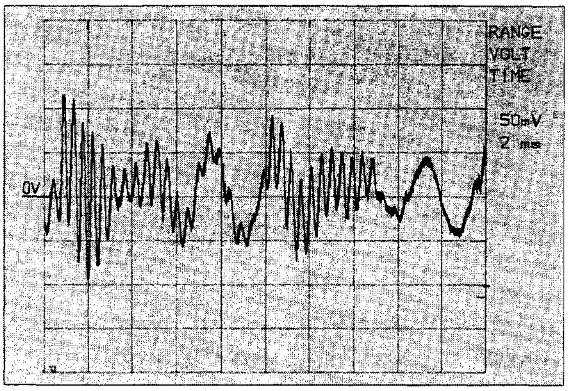
Taking heed of the WARNING above, power up the receiver again and check that:

- the voltage at positive side of C6 (i.e. same as pin 7 of U1) charges up to 16 V then drops to approx. 13 V - if it does not, check FS1 or suspect U1;
- that the reference voltage at LK2 (i.e. junction of R12, R13) is 2.4 V - if it is not, then D9 or U2 is probably faulty.

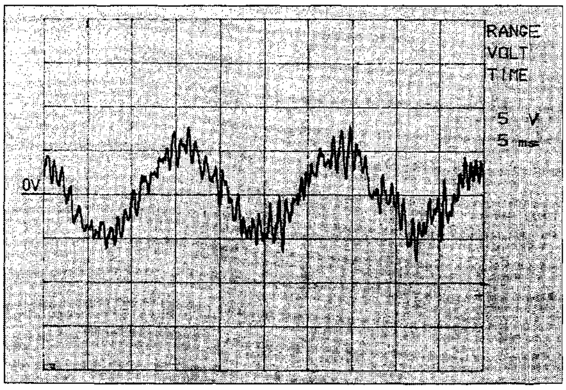
16. AUDIO SOUND PCB



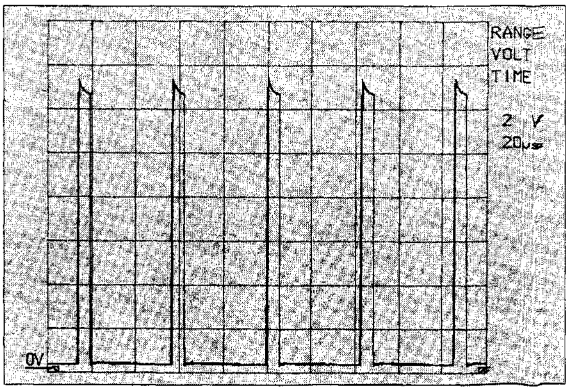
17. AUDIO SOUND PCB



18. AUDIO SOUND PCB



19. SMPS MAIN PCB



Test Point 20: Pin 1 of display (VFD1) (Display PCB)

Description: AC coupled oscilloscope (note position of 0 V)

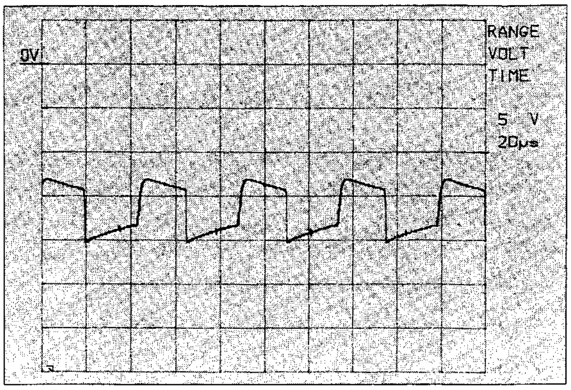
The presence of a trace shows that the vacuum fluorescent display can operate.

If the trace is not detected, check:

- Q6 and associated components on the display PCB;
- Q12, Q13 and associated components on the main PCB which form the oscillator for the 22 kHz signal.

Note: if there is a fault with this oscillator, the tone-switching facility on the LNB supply may also be faulty.

20. CONTROL DISPLAY PCB



Test Point 21: Pin 2 of IR1 (Display PCB)

Description: The trace shows typical data out of the IR sensor; press keys on the handset to obtain the trace.

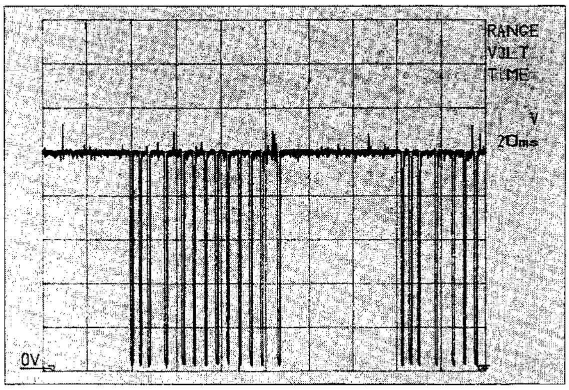
If the trace is not as shown, check:

- the handset and IR1.

Note: when you operate the handset keys, front panel buttons or dial, you could get a situation where the front panel display works (as this is controlled from microprocessor U1 on the display board) but this control information is not being passed to the main PCB. Therefore you should check that there are data, clock and interrupt signals at pins 12, 11 and 4 respectively of U1 when you operate the keys/buttons/dial.

If U1 appears faulty, firstly check that the reset line on pin 63 is at least 4 V and that X1 is oscillating at 4 MHz, as both of these are needed for U1 to operate correctly.

21. CONTROL DISPLAY PCB



Test Point 22: Pin 37 of U22 (Main PCB)

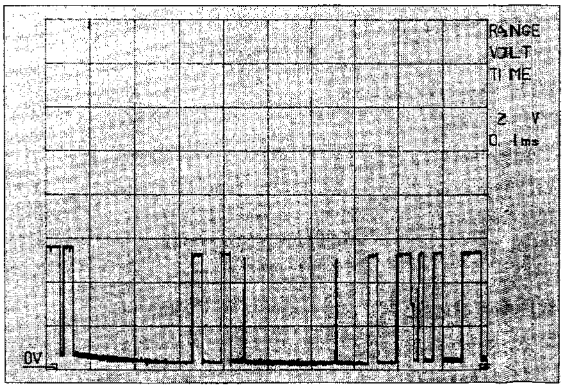
Description: The trace shows a typical serial data (DATA) signal on the I^2C bus when the handset keys are pressed to change the programme number.

Press the number keys while looking for the trace.

If the trace is not as shown, check:

- U22 and any of the ICs on the I^2C bus.

22. CONTROL MAIN PCB



Test Point 23: Pin 10 of U22 (Main PCB)

Description: The trace shows a typical serial clock (SCL) signal on the I^2C bus when the handset keys are pressed to change the programme number. The COMMON_CLK line on pin 29 of U22 should be similar.

Press the number keys while looking for the trace.

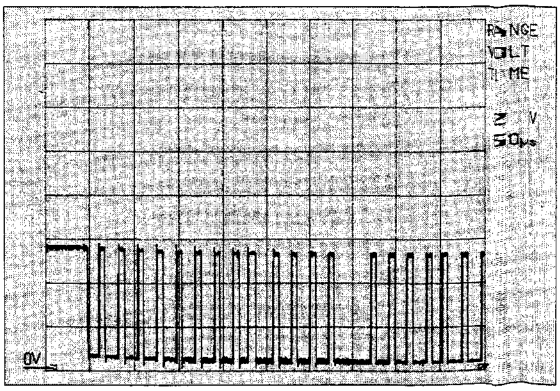
If the trace is not as shown, check:

- U22 and any of the ICs on the I^2C bus.

Note: There are also three clocks associated with the Sound PCB which will give similar traces as follows:

- SCL1SOUND on pin 20 when volume of L or R is changed;
- SCL2SOUND on pin 19 when volume of L or R is changed;
- SURROUNDCLK on pin 36 when sound mode or effect is changed.

23. CONTROL MAIN PCB



NOTE: In VideoCrypt fault tracing, you are not permitted to swap out ICs U3 (on the card reader board), U5, U6, U8, U9 and U29, so if you suspect a fault in these ICs you must return the receiver to the Pace service centre.

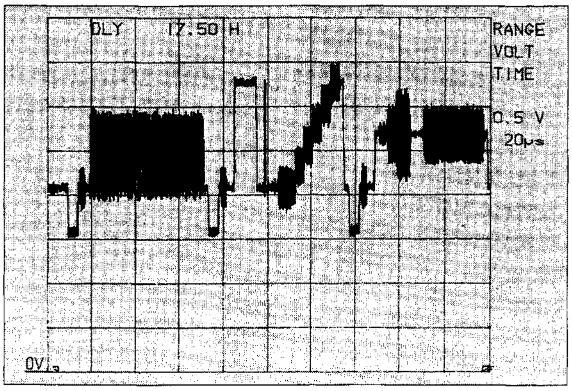
24. VIDEOCRYPT MAIN PCB

Test Point 24: Pin 14 of U5 (Main PCB, VideoCrypt circuit diagram)

Description: This trace shows the clamped video input to the VideoCrypt circuitry (it is the same as Oscillogram 5); its DC level is important - it should be approx. 2 V black level and approx. 1.85 V peak-peak (sync. to bar).

If the DC level is not as shown, check:

- Q62, Q98, Q99 Q100 and their associated circuitry.



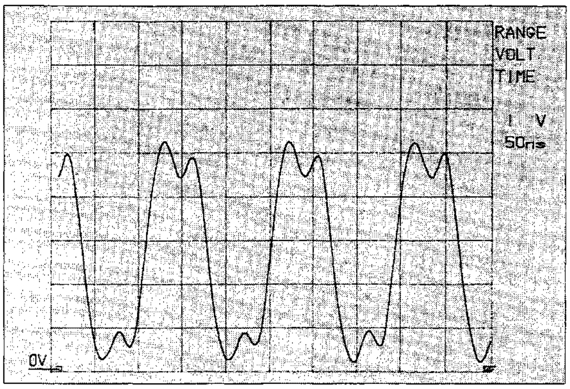
25. VIDEOCRYPT MAIN PCB

Test Point 25: Pin 36 of U5 (Main PCB, VideoCrypt circuit diagram)

Description: The trace shows the 7 MHz clock signal.

If the trace is not as shown, check:

- that X1 is oscillating at 28 MHz.



26. VIDEOCRYPT MAIN PCB

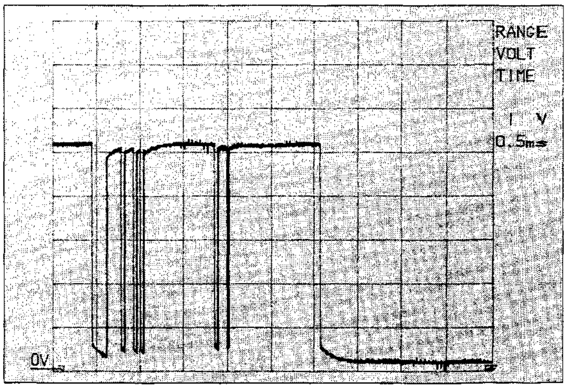
Test Points 26: Pins 23, 24, 25, 26, 27, 28, 29, 30 of U5 (Main PCB, VideoCrypt circuit diagram)

Description: The trace should look similar at all of the above test points, which are the data bus outputs of U5.

Check that all 8 bits of data are present (one bit is associated with each of the above pins). Check that the data has a similar appearance by testing at pins 14 to 21 respectively of U6, at pins 7 to 14 respectively of U8 and at pin 1 to 8 respectively of U9.

If the trace is not as shown, check:

- the appropriate IC and look for shorts or broken tracks on the data bus.



27. VIDEOCRYPT MAIN PCB

Test Point 27: Pin 19 of U29 (Main PCB, main circuit diagram)

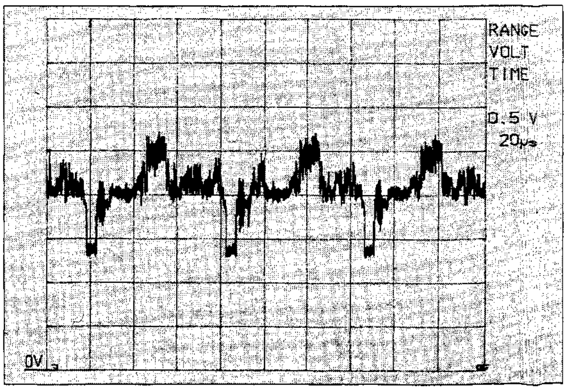
Description: This is the video input to the sync. separator U29. Check the DC level which should be approx. 1.8 V (black level).

If the DC level is not 1.8 V, check:

- that the signal is AC decoupled by C207 (by checking that the voltage is different at LK216).

If the trace is as shown, but there is still a problem, check:

- that the STATION_ID line is high (12 V) at LK74; if it is not then suspect that U29 or associated components are faulty.



Test Point 28: Junction of L28 and X5 (Main PCB, main circuit diagram)

Description: AC coupled oscilloscope

The trace shows the 500 kHz clock signal.

If the trace is not as shown, check:

- L28, R357 and X5

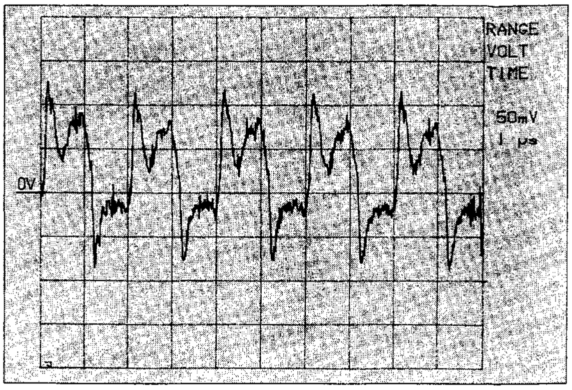
If the trace is as shown, but there is still a problem, check:

- that the reset lines (RST) are greater than 4 V at the following points: U22 pin 6 (main circuit diagram), U5 pin 20 and U8 pin 1 (VideoCrypt circuit diagram)

If any of the above reset lines are less than 4 V, check:

- Q110, Q111, Q114, Q115 and associated components by the connector PL12 pin 3 (main circuit diagram)

28. VIDEOCRYPT MAIN PCB



Test Point 29: LK213 (Main PCB, main circuit diagram)

Description: AC coupled oscilloscope

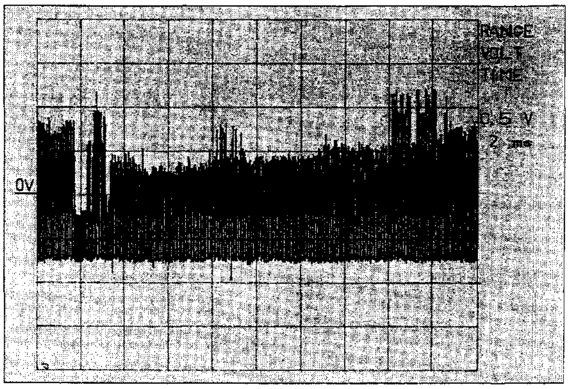
The trace shows the video signal with a scale of 2 ms per division on the time axis. There are three areas of peaks. The first (leftmost) is the vertical sync. and VITS; the other two are the graphics. Oscillogram 29B (see next oscillogram) is a larger scale version of the graphics portion of oscillogram 29A.

The test needs to be carried out when an encrypted programme has been chosen but the viewing card is not inserted (so that graphics messages appear on the screen). Note the voltage level of the inserted graphics.

If the voltage level is not as shown on the trace, check:

- U6, U17 (including R206, R207 and R208), Q101, Q63 and associated circuitry.

29A. VIDEOCRYPT MAIN PCB

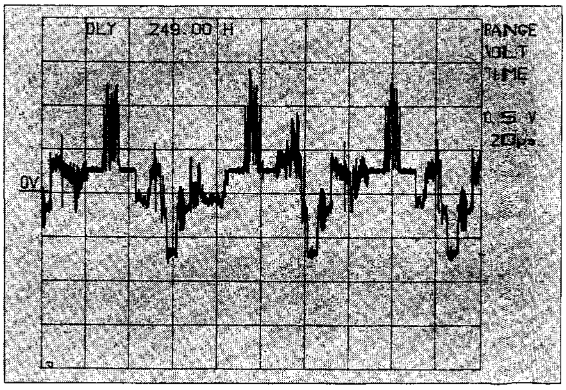


Test Point 29: LK213 (Main PCB, main circuit diagram)

Description: AC coupled oscilloscope

This is a larger scale version of the graphics portion of oscillogram 29A (see preceding oscillogram).

29B. VIDEOCRYPT MAIN PCB



Checks on the Card Reader Board

If the receiver is showing the "CARD INVALID" message, but testing at the test points 24 to 29 has given traces as shown and you appear to have found no faulty components in the VideoCrypt circuitry, you can then carry out some further checks on the card reader PCB as described below.

Supply to the card reader PCB:

- check that the 30 V, 12 V and 5 V rails are present at PL2 of the card reader PCB (pins 3, 5 and 6 respectively); if they are not present, suspect that the ribbon cable between the main PCB and PL2 is broken; if the 30 V is absent, check Q114 (main PCB) and that the reset line (at pin 4 of PL1) is high.

Supply to the card readers:

NOTE 1: For all the tests below, do the tests for one card reader, then move the card to the other one and test that.

NOTE 2: For the first of the three tests below we recommend that you use a **dummy** card (or a SKY card upside down), because a good, valid card could be damaged if there is a problem with the levels of VCC and VPP (which could go as high as 30 V).

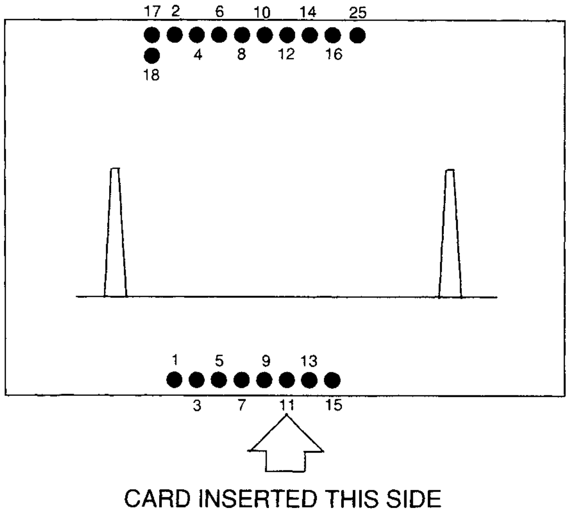
- with the **dummy card** inserted, check that VCC and VPP at pins 9 and 5 respectively of the card reader reach 5 V temporarily as the card is inserted (they do not remain at 5 V unless the card is valid); if they do not reach 5 V, check that VCC and VPP are 5 V at pins 8 and 2 respectively of U3;
- if VCC and VPP are 5 V at U3 but there is still a problem, insert a good card and check Q7, Q8 and associated components (for card reader 1) and Q5, Q6 and associated components (for card reader 2); check also that the card detect line (CD_DET) at pin 17 of U3 goes to 5 V when the card is inserted;
- if there is a difference in the levels of VCC and VPP at the card readers as compared with their levels at U3, check Q2, Q4 and associated components (for card reader 1) and Q1, Q3 and associated components (for card reader 2).

Clock to the card readers:

- check that incoming clock is present at pin 2 of PL1 and the buffered clock output (approx. 3.5 MHz) is present at pin 4 of each card reader (C3CLK line). If there is a problem the clock will be intermittent.

If there is still a problem and the above signals are present, contact the Pace service centre.

Pin Numbering for Card Readers



This is the view from the solder side of the board. (The pins are not accesible from the component side).

GRID REFS - MAIN CIRCUIT (DIAGRAM ON SEPARATE SHEET)

* = not fitted

^ = actually a link (in an inductor position)

A or B = component of different pitch could be fitted

‡ = may be mounted on U22 extension PCB
(NB: C150 as C5, C151 as C6 and X3 as X1)

CAPACITORS

C1	A1
C2	A1
C3	A1
C4	A1
C5	A1
C6	A1
C7	A2
C8	C5
C9	A2
C10	A2
C11	A2
C12	A2
C13	B2
C14	B3
C15	B3
C16	B3
C18	B2
C19	A2
C20	A2
C21	A2
C22	A2
C24	A3
C25	A3
C27	B5
C28	B3
C29	C3
C30	D3
C31	D3
C32	D3
C33	B3
C42	B3
C44	B2
C45	B6
C50	D5
C51	D5
C52	D5
C54	D6*
C55	D6
C56	D6
C57	D6
C58	D6
C59	D5
C60	D6
C61	D6
C62	D6
C64	D6
C65	D5
C66	D6
C67	D5
C68	D6
C69	D5
C70	D6
C71	D6
C72	D6
C73	D6
C74	D6
C75	D6
C76	D6
C77	D6
C78	D6
C79	D6
C80	D6
C81	D6
C82	D6
C85	D5
C85	D6
C86	D5
C87	D6
C88	D6
C89	D6
C90	D6
C91	D6*
C92	D6
C93	D6
C94	D6
C95	D6
C96	D6
C97	D6
C98	D6
C99	D6*
C100	D6
C101	D5
C102	D5
C103	D5
C104	D5
C105	C5*
C106	D5
C107	C5
C108	A4
C109	A4
C110	B4
C111	A5
C112	A5
C113	A5
C114	A5
C115	A4
C116	A4
C117	A4
C118	A4
C119	A4
C120	A4
C121	A4
C122	A4
C123	A4
C124	B6
C125	B6
C126	B4
C127	B4
C128	B4
C130	B4
C133	A6
C134	A6
C135	A6
C136	A6
C137	B6
C138	B6
C139	B6
C140	B6
C141	B6
C142	B6
C143	C6
C144	C6
C145	C6
C146	C6
C147	B5
C148	B5
C149	B5
C150	D4
C151	D4
C153	D4
C154	D4
C155	C5*
C157	C6*
C158	D6
C159	C6
C160	C6
C162	C5
C163	A4
C164	C4
C165	C4
C166	C4
C167	C4
C168	C4
C169	C4
C170	C4
C171	C4
C172	C4
C173	C4
C174	C4
C175	C4
C176	C5
C177	C5
C178	C5
C179	B5
C180	C5
C181	C5
C181	C6
C182	C4
C184	C5
C185	C5
C186	C5
C187	C5
C188	C6
C189	B5
C190	B5
C191	C5
C192	B5
C193	B5*
C194	B5
C196	B5
C198	B3
C199	B3
C200	B2
C211	B3
C212	B3
C213	A4
C214	A4
C215	B3
C216	A2
C217	A2
C219	C5
C220	A6
C250	C5
C251	C5
C252	A4
C253	B5
C254	B5
C255	B5
C256	A3
C257	A3
C259	A2
C261	A2
C262	A3
C263	B4
C270	A1
C273	A3
C274	A2
C275	C5
C280	A2
C287	D5
C288	A2
C289	D5
C291	B4
C293	C4
C295	A2
C400	C6
C401	B2*
C402	A2
C500	D3
C501	B5
C502	C6
C503	C5
C505	A3
C506	A3
C506	A4
C507	A4
C509	B4
C510	B4
C512	A4
C513	A4
C514	A4
C515	A4
C516	A4
C517	D5
C518	D6
C519	D3
C580	C6
C581	B2
C582	B5
C583	C5
C584	C5
C585	B5*
C586	B2
C587	B2
C588	B4
C589	B2
C590	A2
C592	B5
C593	A6
C594	C2
C595	B2
C597	C6
C598	C6
C599	C6
C600	D4
C601	A5
C602	A6
C603	C4
C605	B5
C606	A2
C607	C5
C608	B4
C609	B4
C610	B4
C611	B4
C612	B4
C613	C5
C614	A4
C615	A4
C616	D1
C617	D5
C618	C5
C619	B4
C622	B4
C634	D6
C801	A6
C820	B4
C821	B4

DIODES

D1	A1
D2	A1
D3	A1
D4	A1
D5	A1
D6	A2
D8	A2
D10	A2
D11	A2
D12	A2
D13	B2
D14	A3
D15	A3
D17	A3
D17	A3
D18	B2
D21	A3
D22	A2
D35	D6
D36	D6
D37	D5
D38	A4
D40	B6
D41	B6
D42	C6
D44	C6
D48	B2
D54	A2
D55	A1
D55	A1
D56	A2
D57	C6
D62	A4
D63	C5
D67	D5
D68	B4
D69	B6
D72	A2
D75	A2

INDUCTORS

L1	A2
L3	A2
L6	D6
L7	D6
L9	D5
L10	D6
L11	D6
L12	D6
L13	D6
L15	C4
L16	B5
L17	B5
L18	B5
L19	B4
L20	B3
L21	B3
L22	A4
L25	A4
L31	B2
L39	D6
L40	C4
L41	B5
L42	B5
L43	D3
L44	D3
L45	A2
L45	A3
L47	B4
L48	C4
L49	B4
L49	B3
L50	C4
L51	C1
L52	B2
L53	A4

LINKS

J2	B4
J3	B4
LK2	A2
LK3	B2
LK4	B2
LK6	B3*
LK9	A4
LK10	A4
LK11	A1
LK12	B1
LK13	B1
LK14	B1
LK15	B2
LK16	A3
LK17	B1
LK19	C4
LK20	B1
LK21	B2
LK22	B6
LK23	B2
LK24	B1
LK26	B2
LK27	B1
LK29	B1
LK30	B1
LK31	C4
LK32	B1
LK33	C5
LK34	D4
LK35	A3
LK36	B1
LK37	B1
LK38	B1
LK39	A3
LK40	C5
LK41	B2
LK43	B1
LK45	A3
LK46	C4
LK47	A4
LK48	B1
LK48	B2
LK50	B1
LK51	C1
LK52	B2
LK53	A2
LK54	D5
LK55	C4
LK56	C4
LK57	C4
LK60	C4
LK62	C4
LK63	C4
LK64	B4
LK66	C6
LK69	B4
LK70	C1
LK71	C1
LK72	C4
LK73	C4
LK76	B2
LK77	B2
LK78	B2
LK80	A2
LK81	C4
LK82	C6
LK84	C4
LK85	C1
LK86	C2
LK87	C1
LK88	C1
LK89	D3
LK90	C1
LK91	A2
LK92	B2
LK93	C1
LK94	A5
LK95	D4
LK96	B1
LK96	B1
LK97	D4
LK98	C4
LK99	C4
LK100	C4
LK103	C2
LK105	C4
LK105	D3
LK107	D1
LK108	D3
LK109	D3
LK111	D3
LK112	D3
LK113	D3
LK115	D3
LK117	D3
LK118	B2
LK120	B2
LK122	B2
LK123	C3
LK124	D4
LK125	B2
LK126	B2
LK127	B2
LK134	D1
LK136	D1
LK139	B1
LK141	A4
LK142	C4
LK143	A4
LK145	A3
LK146	A5
LK147	B2
LK148	A5
LK149	B1
LK151	B4
LK152	D3
LK153	B2
LK154	B3
LK155	B3
LK156	B2
LK157	B2
LK159	B4
LK160	B2
LK161	A4
LK162	C6
LK163	C6
LK164	A6
LK166	B1
LK168	B1
LK169	C5
LK170	D5
LK171	C6
LK172	C5
LK173	C6
LK174	C5
LK175	C4
LK177	C5
LK178	A6
LK179	C5
LK180	C6
LK181	C5
LK182	C5
LK183	C5
LK184	B2
LK185	C5
LK186	C5
LK187	C5
LK189	B1
LK191	A4
LK193	B6
LK195	C5
LK196	D4
LK197	B3
LK198	D4
LK199	C5
LK200	C6
LK201	C5
LK202	C6
LK203	C6
LK204	B2
LK205	B2
LK206	B1
LK207	C5
LK208	B2
LK209	B3
LK210	B2
LK211	B3
LK212	A4
LK213	A5
LK217	B2
LK218	A5
LK221	B5
LK224	B2
LK225	C4
LK226	A5
LK227	B5
LK230	B3
LK231	A4
LK232	A4
LK233	B2
LK235	B1
LK236	A3
LK237	A3
LK238	B1
LK239	B5
LK240	A4
LK241	A4
LK242	A5
LK244	B1
LK246	B6
LK247	B5
LK248	B1
LK249	B1
LK250	A6
LK251	A6
LK253	A5
LK256	B6
LK257	B6
LK258	C6
LK259	A6
LK260	A5
LK262	A5
LK263	A6
LK264	B6
LK265	B6
LK266	A5
LK267	C5
LK268	C6
LK269	C5
LK270	A6
LK271	A6
LK272	A5
LK273	C4
LK274	B6
LK275	C5
LK279	B5
LK28	B6
LK280	B4
LK281	B4
LK282	B1
LK282	B2
LK283	A1
LK284	A4
LK287	B1
LK288	A5
LK290	B4
LK291	B4
LK292	C6
LK293	C6
LK294	A5
LK296	D1
LK297	D1
LK298	D1
LK300	C1
LK303	B6
LK304	B5
LK309	B5
LK305	B1
LK306	A4
LK306	B2
LK307	D1
LK308	D1
LK310	D4
LK311	C1
LK312	C1
LK313	C2
LK314	C2
LK315	A2
LK316	A3
LK317	B1
LK317	B1*
LK318	A4
LK319	A4
LK320	A5
LK325	B6
LK668	A4

CONNECTORS

PL2	C1
PL4	C1
PL5	A2
PL7	D1
PL10	B1
PL11	C4
PL11	D4*
PL11	B1
PL12	C1
PL26	C4*
PL26	D3*
PL27	C4
PL27	B3*
PL30	B1

GRID REFS - MAIN CIRCUIT DIAGRAM (cont.)

PL33	B5
PL35	D5*
PL38	A2
SK1	A1
SK2	A5
SK2	B6
SK3	A5
SK3	B6
SK3	C6
SK4	A6

TRANSISTORS

Q1	A2
Q2	A2
Q3	A2
Q4	A3
Q5	A3
Q6	A3
Q7	A2
Q9	A3
Q11	A2
Q12	A3
Q13	A3
Q14	B3
Q15	B3
Q16	B3
Q17	C2
Q30	D6
Q31	D6
Q32	C5
Q33	C5
Q33	D5
Q37	B6
Q38	B6
Q38	B6
Q40	B5
Q41	B5
Q42	B6
Q43	C6
Q44	C6
Q45	C6
Q46	C6
Q47	C6
Q48	C6
Q50	C5
Q51	C5
Q52	C5
Q54	B4
Q55	B4
Q56	B4
Q58	B5
Q59	B5
Q61	A3
Q62	B4
Q63	B2
Q73	A3
Q74	D4
Q75	D4
Q76	D4
Q76	D4
Q77	C5
Q78	B4
Q98	B3
Q100	B4
Q101	B2
Q102	C6
Q103	D5*
Q104	A4
Q105	B2
Q107	B5
Q108	A3
Q109	A6
Q110	C2
Q111	C2
Q112	B6
Q113	B6
Q114	C1
Q115	C2
Q116	A4
Q117	B4
Q118	B4

RESISTORS

R1	A1
R2	A1
R3	A1
R4	A1
R5	A1
R6	A1
R7	A2
R8	A2
R9A	A2
R10	A1
R11	A2
R12	A2
R13	A2
R14	B4
R15	A2
R16	A3
R17	A3
R18	B4
R19	B6
R20	B6
R22	A3
R23	A3
R24	A3
R25	A3
R26	A3
R27	A3
R28	A3
R29	A3
R30	A3
R31	A3
R32	A3
R33	A3
R34	A3
R35	A3
R37	A3
R38	B2
R40	A2
R44	A3
R48	A3
R49	A2
R50	A2
R51	A3
R52	A3
R53	A2
R55	A2
R60	A3
R61	A2
R62	B3
R63	B3
R64	B3
R65	B3
R66	B3
R67	B3
R68	B3
R69	B3
R70	D3
R71	D3
R72	B3
R74	D3
R85	C2
R86	C2
R87	C6
R100	D2
R103	C2
R104	C2
R105	C2
R106	C2
R108	B6
R109	A6
R110	A2
R111	A4
R112	A4
R113	B6
R114	B6
R115	B2
R115	B2
R150	B5
R151	B3
R154	D1*
R155	D1*
R157	D6
R158	D6
R159	D6
R160	D6
R161	D6
R162	D6
R163	D6
R164	D6
R165	D6
R166	D6
R167	D6
R168	D6
R169	D6
R170	D6
R171	D6
R172	D6
R173	D6
R174	D5
R175	D5*
R176	D5
R177	D5
R178	D5
R179	D5
R180	D6
R181	D6
R182	D5
R183	D5
R184	D5
R186	D5
R187	D5
R188	D5
R189	D5
R190	D5
R191	D5
R192	D5
R194	D5
R195	D6
R196	D6
R197	D6
R198	D5
R199	D5
R201	D5
R204	C5
R205	D5
R206	B3
R207	B3
R208	B3
R211	B4
R215	B4
R216	B4
R223	A6
R224	A6
R227	A6
R228	A6
R229	B6
R229	C4
R230	B6
R233	B6
R236	B6
R237	A6
R238	A6
R239	B6
R240	B6
R243	B6
R244	B6
R245	B6
R246	B6
R247	B6
R250	B6
R251	C6
R252	C6
R255	C6
R256	B5
R257	B5
R258	B5
R259	B5
R260	B5
R261	B5
R262	B5
R263	B6
R264	B6
R265	B5
R269	C6
R270	C6
R271	C6
R272	C6
R273	C6
R274	C6
R275	C6
R276	C6
R277	C6
R278	C6
R279	C6
R280	C6
R281	C6
R282	C6
R283	C6
R284	C6
R285	C5
R285	C6
R286	C5
R287	C5
R288	C5
R289	C5
R290	C5
R291	C4
R292	C4
R293	C4
R294	C4
R295	C4
R295	C4
R296	C4
R297	C4
R300	C4
R301	C4
R304	C5
R305	C5
R306	C5
R307	C4
R307	C5
R308	C4
R309	C5
R310	C5
R311	C5
R312	C5
R313	C5
R314	C5
R315	C5
R316	C5
R317	C5
R318	C6
R319	C5
R320	B5
R321	B5
R322	C5
R323	B4
R324	B4
R325	B4
R326	B4
R327	C4
R328	B4
R329	B4
R330	B4
R331	B4
R332	B5
R333	B5
R334	B5
R335	B5
R336	B5
R337	B5
R339	B3
R340	B3
R342	A3
R343	A3
R345	B5
R346	B3
R347	B2
R348	B4
R348	B2
R349	B2
R365	A2
R367	A1
R368	A2
R369	A1
R380	B6
R382	C6
R383	C4
R385	C2
R396	A6
R397	A6
R398	C6
R399	C6
R400	C5
R401	C5
R404	B2
R417	D1
R419	A3
R420	B2
R421	A6
R422	D4
R423	D4*
R424	D4
R425	D4
R426	D4
R426	D4
R427	D4
R428	C5
R429	A2
R430	C6
R431	C4*
R432	C4
R433	C6
R434	C6
R435	B6
R436	B6
R437	B3
R442	B4
R443	B4
R444	B4
R445	B4
R446	C4
R450	D1
R506	D1
R512	C4
R515	D4
R520	A2
R521	B6
R523	B4
R534	B2
R535	B2
R539	B3
R541	B2
R542	B2
R543	A6
R544	A6
R545	B1
R546	C6*
R547	C5
R548	C5
R554	D5
R555	D5
R556	D5*
R559	A3
R560	D4
R561	B1
R562	A6
R567	A6
R572	B1
R574	C5
R575	B5
R576	D6
R577	D6
R578	D6
R579	D6
R580	D6
R581	C6
R583	A6
R590	C1
R592	B4
R594	A1
R594A	A2
R595	C4
R596	B2
R598	D3
R599	D4
R601	D5
R602	D5
R603	D4
R606	C5
R607	C5
R612	C4
R616	D5
R617	D4
R618	A3
R619	D5
R620	A3
R621	B3
R625	B4
R625	C4
R626	B4
R631	B6
R632	B6
R633	D4
R634	A5
R635	B3
R636	D4
R637	B4*
R639	A4
R640	A4
R641	A4
R642	B4
R643	B4
R644	B4
R645	A4
R646	A4
R647	A4
R648	A4
R649	A4
R650	A4
R651	D5
R652	A4
R653	D4
R654	B6
R655	A2
R656	B6
R657	C1
R658	D4
R659	D4
R660	D5
R661	D5
R662	D5
R663	A3
R665	D4
R666	D5
R667	B5
R671	B4
R673	C4
R674	C4
R675	C4
R676	C4
R677	C5
R680	D4
R681	A2
R682	C5
R700	D6
R704	B3
R705	B2
R705	B2
R707	B2
R708	B2
R709	C4
R710A	A2
R711A	A2
R712	B4
R714	C5
R715	C5
R716	B5
R722	D4
R723	C4
R724	C4
R725	C4
R727	B1
R728	C5
R729	B4
R730	B5
R731	A3
R732	A3
R733	A3
R734	A3
R735	A6
R738	A6
R740	C2
R741	C2
R742	C2
R743	C2
R745	A2
R747	C6
R748	B6
R749	B6
R751	C6
R752	C6
R753	D1
R754	D5
R754	D5
R755	A5
R758	B6
R759	A6
R761	B4
R764	D4
R765	B5
R766	B6
R767	D4
R768	D4
R769	D4
R771	C4
R772	C4
R774	C1
R776	A6
R777	B5
R780	A5
R780	C2
R781	A5
R782	A5
R784	A5
R785	A6
R787	D4
R788	C6
R789	B5
R789	D4
R790	C2
R791	D4
R791	C2
R792	B6
R793	B6
R794	B5
R795	B1
R797	D4
R799	B2
R800	B1*
R802	B6
R803	D1
R804	A1
R805	B2
R806	B2
R807	B2
R810	A4
R811	C1
R812	B5
R813	B3
R818	A4
R819	A4
R820	A4
R821	B5
R822	D5
R823	B1
R824	B4
R825	B4
R825	B5
R826	B4
R827	B4
R828	B4
R829	B4
R829	B5
R830	B2

ICS

U1	A1
U2	A2
U3B	A3
U5	D2
U7	C4
U8	C2
U9	A2
U9	D2
U15	D6
U16	D6
U17	B2
U18	A5
U19A	A4
U19C	B4
U19D	B4
U20	B6
U21	B5
U22	D4
U25	D4
U26	C5
U27	C5
U30	A4
U31A	C4
U31B	C4
U32	B4

MISC. COMPONENTS

FS22	A2
HS1	A2
HS2	A2
HS3	A2
HS5	A3
T1	A1
TUNER1	C6
X2	A5
X3	D4
X4	C4
X6	A3
X7	B5

continued overleaf

INTERCONNECTIONS

+5V MOD	D5
AUDIOMOD	B3, B3, D5
AUX/STAT	B6, D5
AV/AUDIO	B5, B6, D4
BANDWIDTH	C6, D4
BLOCK	B2, C3
CARDSEL1	B1, C1, D4
CBAND	C5, D4
CD_DET	B1, C1, D4
CHAR	B2, C3
CMD3M5	D3, D3
CMD7M	D3, D3
COMMON_CLK	C1, C1, C4, D4
DATA	B5, C1, C1, C1, C1, C4, D4, D4, D5
DEC_STAT	C6, D5
DISH_POS_DATA	C6, D5
DP1	D5
DP2	C5
DP3	D5
DP4	C5
DPLD-SCL1	C1, C1, D4
FP/MAC_DATA	D1, D5
FP/MAC_INT	D1, D5
FP_CLK	D1, D5
FP_FILAMENT	A3, D1
H/V POLARITY	A3, D4
HSY	C3, C3
IVIDEO	C3, B3
IVIDEO1	D3
L-IN	A3, C1, C1
LNB ON/OFF	A3, D4
LNB SELECT	C6, D4
LNB SHORT	A3, C4
MOD_VID_SRC	A4, D4
NOISE_SEL	B5, C1, C1
OF1	B5, C5
OF10	D6
OFF3	B1, C4, D2
OVIDEO	B3, C3
PL30-4	B2, D2
Q3.3	B2, C1, C1
Q63.1	A5
R_IN	A3, A6, C1, C1
R330	B6
R435-J2	A4
R436-J3	A4
R548	A3
R556	A6
R599	B2, C5
R600	D5
R714	B6
R820	B5
RST	B2, B4, C2, D1, D3, D4
SCL	A5, C1, C1, C4, C5, D5
SCLSOUND	C1, C1
SK3-40	B4
SK3-41	C5
SPEAKER_SEL	A4, C1, C1, D5
STATION_ID	B4, D5
STBY	A3, D4
SUROUND CLK	C1, C1
TO MODULATOR	A3
TONE_ON/OFF	A3, D4
TUNING_VOLTS	B3, B3, C5
TVSTAT	B6, D5
U17PIN5	A2
U18-14	A4
U21.1 (VCR)	A4
U30.14	B6
U30.2	B5
U30.4	B6
U30PIN14	B4
U30PIN4	B4
U6.5	D3
U6.6	D3
VCRSTAT	A6, D5
VID_OUT	A3, B5
VIDEO1	B3
VREF	B3, B3, D3, D3
VSY	C3, C3

GRID REFS - SOUND BOARD CIRCUIT (DIAGRAM ON SEPARATE SHEET)

* = not fittted

CAPACITORS

C1	C6
C2	C5
C3	A6
C4	A5
C5	A5
C6	A5
C7	A3
C8	A3
C9	A4
C10	A4
C11	A3
C12	A3
C13	A4
C14	A3
C15	A3
C16	A4
C17	D3
C18	B4
C19	A4
C20	B3
C21	B3
C22	B3
C23	B3
C24	B3
C25	B3
C26	A4
C27	A4
C28	B4
C29	B4
C30	D3
C31	D4
C32*	B2
C33	D3
C34	C3
C35	C3
C36	C3
C37	C4
C38	B4
C39	B4
C40	B4
C41	D5
C42	D5
C43	C5
C44	C5
C45	C5
C46	C5
C47	C4
C48	C4
C49	D4
C50	C4
C51	C5
C52	C4
C53	D4
C54	C4
C55*	A2
C56	C6
C57	B6
C58	C5
C59	D5
C60	D3
C61	C6
C62	B3
C63	A3
C64	A3
C65	C6
C66	C2
C67	C1
C68	C1
C69	C1
C70	C1
C71	C1
C72	C1
C73	C1
C74	C1
C75*	C3
C76	B3
C77	C2
C78	B1
C79	B1
C80	B1
C81	B1
C82	B1
C83	B1
C84	C1
C85	C1
C86	C3
C87	B3
C88	C3
C89	C3
C90	C3
C91	D2
C92*	C2
C93	C2
C94	C2
C95	D2
C96	D2
C97	B3
C98	B3
C99*	B3
C100	B2
C101	B3
C102	B2
C103	B2
C104	B2
C105	B2
C106	B2
C109	C3
C110	B3
C111	C6
C112	C6
C120	B4
C121	A5
C122	D3
C123	B2
C124	B2

DIODES

D1	A1
D2	A1
D3	B4
D4	A4
D5	A4
D6	A4
D7	A4
D8	A5
D9	B2
D10	A3

LINKS

J1	D3
J2	D2
J3*	B2
J4	B3
J5	B2
J6	A2
J7	A2
J8*	A2
J9*	B2
J10	B2
J11*	A2
LK1	A2
LK2	D6
LK3	A6
LK4	C6
LK5	B2
LK6	D6
LK7	B1
LK8	B1
LK9	B3
LK10	B2
LK11	C5
LK12	D5
LK13	D6
LK14	C5
LK15	C4
LK16	C4
LK17	B4
LK18	D5
LK19	D6
LK20	D6
LK21	D5
LK22	D5
LK23	D5
LK24	D5
LK25	A5
LK26	A4
LK27	B4
LK28	B4
LK29	D5
LK30	C3
LK31	D6
LK32	D5
LK33	B4
LK34	B3
LK35	C4
LK36	D6
LK37	D4
LK38	B3
LK39	D5
LK40	D6
LK41	A5
LK42	C4
LK43	C3
LK44	D5
LK45	A2
LK46	B2
LK47	A1
LK49	A3
LK51	C2
LK52	D3
LK53	D5
LK54	B1
LK55	B2
LK56	D3
LK57	C2
LK58	D3
LK59	D6
LK64	D5
LK65	C1
LK66	C2
LK67	C3
LK68	D2
LK70	B3
LK71	B2
LK72	B2
LK73	D5
LK75	D6
LK76	D5
LK77	D6
LK78	D5
LK79	D5
LK80	D5
LK81	B4
LK82	C5
LK83	A3
LK84	D6
LK85	D5
LK86	B1
LK87	C1
LK88	B3
LK89	B
LK90	B2
LK92	C1
LK93	C1
LK95	C6
LK96	C2
LK97	D5
LK98	C2
LK99	C2
LK100	B2
LK101	C2
LK102	B3
LK103	C2
LK104	B2
LK105	C1
LK107	B2
LK108	C1
LK109	C2
LK110	A1
LK111	A1
LK112	B1
LK113	B1
LK114	C1
LK115	B1
LK116	B1
LK117	A1
LK121*	D6

CONNECTORS

PL1-1	B1
PL1-2	C2
PL1-3	C3
PL1-4	B3
PL1-5	B3
PL1-6	B2
PL2	C6
PL3	D6
PL4	C1
PL6-1*	B1
PL6-2*	D2
PL6-3*	D3
PL6-4*	B3
PL6-5*	B3
PL6-6*	B2
PL7*	D6
PL8*	C6
SK1A	C1
SK1B	C1
SK1C	B1
SK1D	B1

TRANSISTORS

Q1	C3
Q2	B3
Q3	A2
Q4	A1
Q5	C4
Q6	A1
Q7	B1
Q8	A1
Q9	A1
Q10	A1
Q11	A5

RESISTORS

R1	D5
R2	A5
R3	A5
R4	A5
R5	A3
R6	A3
R7	A3
R8	A4
R9	A3
R10	A4
R11	A3
R12	A3
R13	A3
R14	A3
R15	A2
R16	B1
R17	B1
R18	A1
R19	B3
R20	B3
R21	B3
R22	B4
R23	B3
R24	B3
R25	B3
R26	B4
R27	C3
R28	C3
R29	C4
R30	C4
R31	D5
R32	C5
R33	C5
R34	C5
R35	C5
R36	C4
R37	B4
R38	C4
R39	C4
R40	C4
R41	C4
R42	D4
R43	D4
R44	D4
R45	C4
R46	C4
R47	D3
R48	C3
R49	C4
R50	A1
R51	C3
R52	A1
R53	D4
R54	C4
R55	A4
R56	A4
R57	A4
R58	A4
R59	C3
R60	B3
R61*	A2
R62*	A2
R63	B4
R64	B4
R65	A4
R66	A4
R73	A2
R78	C1
R79	C1
R82	A5
R83	B2
R84	B1
R85	B1
R89	A2
R105	C4
R106	C4
R107	B1
R108	B1

ICS

U1A	C5
U1B	B4
U1C	C5
U1D	D5
U2A	A3
U2B	B3
U2C	B2
U3	B6
U4	B5
U5A	C4
U5B	C3
U5C	D3
U5D	D3
U6	D3
U7A	C4
U7B	B4
U7C	B4
U7D	B3
U8A	A4
U8B	A4
U8C	A3
U8D	A3
U9	B2
U10A	B3
U10B	C3
U10C	D4
U10D	C4
U11	C1
U12	B1

MISC. COMPONENTS

X1	A5

INTERCONNECTIONS

C86_MUTE	A1, C3
C93_MUTE	A1, C2
C100_MUTE	A1, C2
C104_MUTE	A1, B2
COMMON_CLK	A6, D6
DATA	A6, C2, B2, D6
DPLD_WIDE	C4, C6
L_IN	A2, D6
NOISE_SEL	A6, C6
PWR_MUTE	A1, B2, C2
R_IN	B2, D6
SCL1SOUND	C2, D6
SCL2SOUND	B2, D6
SPEAKER_SEL	A2, B3, D6
SURROUNDCLK	A6, D6

GRID REFS - DISPLAY BOARD CIRCUIT (DIAGRAM ON SEPARATE SHEET)

* = not fitted

CAPACITORS

C1	D3
C2	D6
C3	B3
C4	B3
C5	B3
C6	B3
C7	B2
C8	B2
C10	C1
C11	C1
C12	B2
C14	D6
C15	B3
C16	B3
C17	B3
C18	D3
C19	B3
C20	B1
C21	B1
C22	C1

DIODES

D1	A3
D2	A2
D3	A3
D4	A3
D5	B1

INDUCTORS

L1	B2

LINKS

J1	B3
LK1	B1
LK3	C1
LK4	B1
LK5	C2
LK6	C3
LK8	C3
LK9	C3
LK10	C3
LK11	C3
LK12	C3
LK13	C3
LK14	C3
LK15	C3
LK16	C3
LK17	C3
LK18	A1
LK19	A3
LK20	C3
LK21	B2
LK22	A1
LK23	D4
LK24	C2
LK25	A2
LK26	A1
LK27	D4
LK28	D4
LK29	D4
LK30	D4
LK31	C3
LK32	C1
LK33	C2
LK34	B2
LK35	D4
LK36	D4
LK37	D4
LK38	D4
LK39	D4
LK40	C4
LK41	C4
LK42	C4
LK43	A5
LK44	B5
LK45	D6
LK46	A5
LK47	B2
LK48	A4
LK49	D6
LK50	B5
LK51	B2
LK52	B2
LK53	B2
LK54	B3
LK55	B6
LK56	B2
LK58	B3
LK59	A2
LK60	A2
LK61	B3
LK62	B1
LK63	B2

CONNECTORS

PL1	B1
PL2	C2
PL3	C2

TRANSISTORS

Q1	C5
Q2	B5
Q3	B5
Q4	A5
Q5	D6
Q6	D6
Q7	A5
Q8	B1
Q9	A2
Q10	A2

RESISTORS

R1	D3
R2	D3
R3	C5
R4	C5
R5	B5
R6	B5
R7	B5
R8	B5
R9	B5
R10	A5
R11*	D6
R12*	D6
R13	A5
R14	A5
R15	B2
R16	B2
R17	C6
R18	B6
R19	B6
R20	B6
R21	A6
R22	A2
R23	A2
R24	A3
R25	A3
R26	B1
R27	B1
R29	C2
R30	A2
R31	A2
R32	D3
R33	D3
R34	D3
R36	D6
R37	D6
R38	B1

SWITCHES

SW1	A3
SW2	A3
SW3	A3
SW4	A2
SW5	C1

ICS

U1	B4

MISC. COMPONENTS

IR1	B2
LED1	A2
LED2	A2
LED3*	B1
VFD1	D6
X1	B3

INTERCONNECTIONS

FP_FIL	C2, D6
RST	B3, C1

GRID REFS - CARD READER BOARD CIRCUIT (DIAGRAM ON SEPARATE SHEET)

* = not fitted

CAPACITORS

C1	C5
C2	C5
C3	C5
C4	B5
C5	B6
C6	D5
C7	D5
C8*	B6
C9	B6
C10	C6
C11	D4
C12	D4
C13	A2
C14	A2
C15	D5

DIODES

D1	C5
D2	B5
D3	C5
D4	B4
D5	B6
D6	B5
D7	B6
D8	A5

LINKS

J1*	C3
J2*	C2
J3*	A4

CONNECTORS

PL1	C6
PL2	B6

TRANSISTORS

Q1	C4
Q2	C4
Q3	C4
Q4	C4
Q5	C3
Q6	C3
Q7	C3
Q8	C3

RESISTORS

R1	C5
R2	C5
R3*	B4
R4*	B4
R5*	A4
R6	C4
R7	C4
R8	C3
R9	C3
R10	C3
R11	C3
R12	C3
R13	C3
R14	C3
R15	C3
R16*	A4
R17	D5
R18	D5
R19	C5
R20	D4
R21	C2
R22	A2
R23	C2
R24	C2
R25	C1
R26	C2
R27	B4
R28	A4
R29	B4
R30	B2
R31	A2
R32	A4
R33	B5
R34	C5
R35	C5
R36	C4
R37	C4
R38	C4
R39	C4
R40	B6

ICS

U1	C5
U2	B5
U3	D5
U4A	C6
U4B	C6

MISC. COMPONENTS

CARD1	C1
CARD2	B1

GRID REFERENCES - POSITIONER BOARD CIRCUIT

CAPACITORS

C1	D6
C2	D6
C3	D6
C4	D6
C5	D5
C6	D5
C7	D5
C8	D5
C9	D5
C10	D5
C11	D5
C12*	D4
C13	D4
C14	D5
C15	C5
C16	C5
C17	C5
C18	C5
C19	B5
C20	B5
C21	B5
C22	B5
C23	B5
C24	A6
C25	B6
C26	B5
C27	A5
C28	C3
C29	C3
C30*	C3
C31	C3
C32	D3
C33	D3
C34	D2
C35	D2
C36	D2
C37	C4
C38	C2
C39	C2
C40	C2
C41	C2
C42	C1
C43	C1
C44	C1
C45	B4
C46	B4
C47	B3
C48	B2
C49	B1
C50	B1
C51	B1
C52	A3
C53	A4
C54	A3
C55	A3
C56	B1

DIODES

D1	D5
D2	B6
D3	B6
D4	D2
D5	C2
D6	B4
D7	B3
D8	B3
D9	B2
D10	B2
D11	B2
D12	B2
D13	B3
D14	A3
D15	A3
D16	A2
D17	B2
D18	B1
D19	B1
D20	B2

TRANSISTORS

Q1	D6
Q2	D5
Q3	B6
Q4	C4
Q5	C2
Q6	B4
Q7	B3
Q8	B3
Q9	A4

RESISTORS

R1	D6
R2	D6
R3	D6
R4	D6
R5	D6
R6	D6
R7	D6
R8	D5
R9	D5
R10	D5
R11	D5
R12	D5
R13	D5
R14	D4
R15	D4
R16	D4
R17	D4
R18	D4
R19	D4
R20	D4
R21	D4
R22	C5
R23	C5
R24	D4
R25	C5
R26	C5
R27	C5
R28	C5
R29	C5
R30	C5
R31	C5
R32	C5
R33	C5
R34	C5
R35	B5
R36	B5
R37	B6
R38	B6
R39	B6
R40	B6
R41	C4
R42	C4
R43	C4
R44	C4
R45	C4
R46	C4
R47	C4
R48	C4
R49	C4
R50	C4
R51	C4
R52	D4
R53	C4
R54	C3
R55	C3
R56	C3
R57	C2
R58	C2
R59	C2
R60	C2
R61	C2
R62	B4
R63	B3
R64	B3
R65	B2
R66	B2
R67	B1
R68	A4
R69	B3
R70	B3
R71	A3
R72	A4
R73	A4
R74	A4
R75	A3
R76	A3
R77	A3
R78	A3
R79	A2
R80	A2

ICS

U1A	D4
U1B	C3
U2	C5
U3A	D5
U4	C4
U5	D3
U6	D3
U7	D2
U8	C2
U9	B3
U10A	A3

MISCELLANEOUS

L1	D6
RL1A	B2
RL1C	B3
RL2A	B2
RL2C	B4
X1	D6
X2	B5

GRID REFS - IDENT DIAGRAMS FOR MAIN PCB

* = not fitted
† = mounted on copper (SMD) side of PCB
^ = actually a link (in an inductor position)
° = actually a capacitor (in a resistor position)
A or B = component of different pitch could be fitted
‡ = may be mounted on U22 extension PCB
(NB: C150 as C5, C151 as C6 and X3 as X1)

CAPACITORS

C1	C2
C2	E3
C3	F2†
C4	F2†
C5	F3
C6	G4
C7	K3
C8	G15†
C9	L2
C10	P6
C11	Q4
C12	Q5
C13	Q7
C14	N8
C15	N9
C16	N8†
C18	Q7†
C19	Q4†
C20	Q4†
C21	K6
C22	P2†
C24	O12†
C25	O11†
C27	F19†
C28	L18†
C29	Q21†
C30	L21†
C31	K21†
C32	K20†
C33	L20†
C34	L22†
C35	K25†
C38	L22†
C39	L22†
C40	L22†
C41	P13†
C42	K18†
C44	Q20†
C45	E20†
C50	H7†
C51	H7†
C52	G7†
C54	D9
C55	B9†
C56	B9†
C57	B8†
C58	B8†
C59	C8†
C60	C9†
C61	D9†
C62	D8†
C63	C9†
C64	C8†
C65	D8†
C66	D7†
C67	D8†
C68	C8†
C69	D8†
C70	D7†
C71	E7†
C72	F8†
C73	F8†
C74	F8†
C75	F7†
C76	G8†
C77	G8†
C78	F8†
C79	G7†
C80	E8†
C81	E8†
C82	E8†
C83	E7†
C85	E7†
C86	H7†
C87	G7†
C88	E9†
C89	E9†
C90	E9†
C91	F9
C92	F9†
C93	F9†
C94	E9†
C95	E9†
C96	E9†
C97	G9†
C98	G8†
C99	F7†
C100	G9†
C101	H7
C102	H8†
C103	H8
C104	H8
C105	H8†
C106	D11†
C107	E11
C108	H25†
C109	H26†
C110	F24†
C111	G25
C112	G25†
C113	I26†
C114	H26†
C115	F25†
C116	F25†
C117	F26
C118	F25†
C119	F25†
C120	E24†
C121	E24†
C122	F26
C123	E26
C124	F24†
C125	F24†
C126	F23†
C127	F23†
C128	G22
C130	H22†
C131	C12
C132	E16
C133	D16
C134	D17
C135	D16
C136	C11
C137	E17
C138	E17
C139	D21
C140	D21
C141	D17
C142	D18
C143	C22
C144	C22
C145	D22
C146	C21
C147	F23
C148	F24†
C149	G19
C150	N11†
C151	N11†
C153	M10
C154	J9†
C155	N11†
C157	G11†
C158	G11
C159	D11†
C160	F11
C161	F10
C162	F12
C163	J26†
C164	O18†
C165	P17
C166	O18†
C167	N17†
C168	O19
C169	P17
C170	P18†
C171	P18†
C172	Q18†
C173	Q18
C174	Q18†
C175	Q17†
C176	F13
C177	H13
C178	G13†
C179	G14†
C180	G13†
C181	H13†
C182	H13†
C184	H13
C185	E12
C186	E13
C187	E12
C188	H11†
C189	F16†
C190	F16†
C191	G15†
C192	F17†
C193	G17†
C194	G16
C196	H17
C198	H15
C199	K17†
C200	M17
C201	K17
C202	K16†
C203	K16†
C204	K16
C205	L15†
C206	K15†
C207	K17†
C208	L15
C209	L15†
C210	M15†
C211	K18†
C212	K17†
C213	E24†
C214	E24†
C215	K18†
C216	P2
C217	G2†
C219	H14†
C220	C25
C221	C25
C222	C26
C223	C26
C224	C23
C250	G14†
C251	G14†
C252	F26†
C253	H24†
C254	G14†
C255	G14†
C256	P9†
C257	O10†
C258	M16
C259	P6†
C260	Q6
C261	Q5†
C262	O9
C263	O15†
C270	G2†
C273	P10†
C274	O10†
C275	F14†
C287	L11†
C288	L8
C289	H9
C291	O16†
C293	F21
C294	M15
C295	J3
C400	J7†
C401	M16†
C402	J4
C500	L20†
C501	G16
C502	D12
C503	E14
C505	Q12
C506	Q12†
C507	F22
C508	H22†
C509	E22
C510	G22†
C512	H21†
C513	H26†
C514	H26†
C515	G26†
C516	H26†
C517	F7
C518	F7†
C519	M20
C580	F11†
C581	L17
C582	F17†
C583	F14†
C584	F16†
C585	F15†
C586	M18
C587	Q20
C588	P16†
C589	Q8
C590	N7
C591	L23
C592	F15†
C593	D13
C594	Q26
C595	L19†
C596	L16†
C597	B10
C598	C10
C599	F10†
C600	L11†
C601	F26†
C602	D14†
C603	G13†
C604	M22
C605	H17†
C606	K2
C607	F15†
C608	D19
C609	N26
C610	G23
C611	F23†
C612	F23†
C613	H13†
C614	I26†
C615	I26†
C616	K20†
C617	N12†
C618	F14†
C619	G16†
C620	H16†
C621	H15†
C622	H15†

DIODES

D1	F5
DP1	H13
D2	F5
DP2	J11
D3	E4
DP3	M10
D4	F4
DP4	J11
D5	G2†
D6	I2
D8	J5
D9	M2
D10	O5
D11	N4
D11A	N4
D12B	N4
D12	N4
D13	O6
D14	P11†
D15	O9
D17	Q9†
D18	Q9
D21	Q9
D22	Q6
D35	B8†
D36	G8†
D37	E7†
D38	F26
D39	I12†
D40	E21†
D41	M10†
D42	M14†
D44	G11
D48	M17†
D49	M14†
D50	L14†
D51	M15†
D52	L14†
D53	L14†
D54	N2
D55	G3†
D56	N5
D57	N15†
D62	R9
D63	P11†
D67	I7
D68	P15†
D69	D21†
D71	D15†
D72	J4

INDUCTORS

L1	L7
L3	M8
L5	L22
L6	B9
L7	B8
L8	C7
L9	E7
L10	G8
L11	G8
L12	E7
L13	E9
L15	Q18
L16	F15
L17	F16
L18	G17
L19	H16
L20	K18
L21	K17
L22	F27
L23	I24
L25	H26
L27	L16
L28	K14
L31	Q20
L35	L22
L36	L22
L39	D10
L40	N18
L41	I12
L42	E15
L43	N19
L44	N19
L45	H10
L46	K4
L47	Q15
L48	P15
L49	I10
L50	I10
L51	Q13
L52	M19
L53	I26

LINKS

LK2	N5
LK3	Q3
LK4	P6
LK6	K19†
LK7	C23
LK8	C23
LK9	H21†
LK10	I21†
LK11	G3
LK12	N7
LK13	N8
LK14	K7
LK15	J7
LK16	J7
LK17	J8
LK19	K9
LK20	M9
LK21	M9
LK22	M9
LK23	M9
LK24	N9
LK25	N9
LK26	L9
LK27	L9
LK28	L10
LK29	J10
LK30	K10
LK31	K10
LK32	N10
LK33	N10
LK34	N10
LK35	N11
LK36	N11
LK37	I11
LK38	H12
LK39	O10
LK40	O10
LK41	O11
LK43	P12
LK45	P12
LK46	Q13
LK47	Q13
LK48	Q13
LK50	Q13
LK51	P14
LK52	P13
LK53	P13
LK54	O13
LK55	Q14
LK56	Q14
LK57	Q14
LK58	Q15
LK60	Q15
LK62	O14
LK63	O13
LK64	O15
LK65	N14
LK66	N14
LK68	O15
LK69	O15
LK70	N13
LK71	N13
LK72	N13
LK73	N16
LK74	N16
LK75	N16
LK76	N16
LK77	N16
LK78	O17
LK80	M15
LK81	N13
LK82	M14
LK83	M14
LK84	N15
LK85	M14
LK86	L13
LK87	M13
LK88	M13
LK89	L13
LK90	L14
LK91	M17
LK92	K14
LK93	K14
LK94	L17
LK95	L17
LK96	L18
LK97	Q16
LK98	P18
LK99	O18
LK100	Q19
LK101	P20
LK103	P20
LK105	P20
LK106	O19
LK107	N19
LK108	N19
LK109	N19
LK110	N21
LK111	N21
LK112	N21
LK113	M21
LK114	N22
LK115	N22
LK116	N22
LK117	M22
LK118	O22
LK119	O23
LK120	Q23
LK121	M22
LK122	M22
LK123	K22
LK124	K22
LK125	K23
LK126	K23
LK127	K23
LK128	Q25
LK129	P25
LK130	P25
LK131	P25
LK132	P25
LK133	P25
LK134	O25
LK135	O25
LK136	O25
LK137	N25
LK138	N25
LK139	M26
LK140	M25
LK141	L26
LK142	L26
LK143	L26
LK145	K26
LK146	J26
LK147	K26
LK148	I26
LK149	H26
LK151	M19
LK152	L19
LK153	L19
LK154	L19
LK155	K19
LK156	K19
LK157	J19
LK159	J19
LK160	K19
LK161	G26
LK162	G26
LK163	F26
LK164	F27
LK166	I10
LK168	H10
LK169	H10
LK170	H10
LK171	H10
LK172	G10
LK173	H11
LK174	H11
LK175	I11
LK176	I12
LK177	I12
LK178	J14
LK179	I13
LK180	H12
LK181	H12
LK182	G12
LK183	F11
LK184	F12
LK185	E14
LK186	E12
LK187	E13
LK189	E13
LK190	D14
LK191	J13
LK193	J13
LK195	I13
LK196	J13
LK197	I14
LK198	J14
LK199	I12
LK200	J14
LK201	J14
LK202	J15
LK203	I15
LK204	H14
LK205	I15
LK206	J15
LK207	G14
LK208	G14
LK209	G15
LK210	G15
LK211	I16
LK212	J16
LK213	J16
LK216	J16
LK217	J16
LK218	I16
LK221	I17
LK224	I17
LK225	I17
LK226	H17
LK227	H18
LK228	J19
LK230	J19
LK231	I20
LK232	I19
LK233	I20
LK235	G21
LK236	I21
LK237	I22
LK238	I22
LK239	I23
LK240	I22
LK241	H23
LK242	G21
LK244	G21
LK246	F21
LK247	F21
LK248	F22
LK249	E21
LK250	E22
LK251	E22
LK253	C21
LK256	D22
LK257	D22

GRID REFS - IDENT DIAGRAMS FOR MAIN PCB (cont.)

LK258	D22
LK259	D23
LK260	D20
LK262	C16
LK263	C16
LK264	C16
LK265	B16
LK266	B17
LK267	E18
LK268	E18
LK269	E18
LK270	F18
LK271	F19
LK272	F18
LK273	E19
LK274	E18
LK275	E19
LK279	I17
LK280	J19
LK281	I18
LK282	Q6
LK283	G5
LK284	K26
LK287	I19
LK290	E23
LK291	E23
LK292	D24
LK293	D24
LK294	G22
LK296	Q20
LK297	R26
LK298	R13
LK300	M13
LK303	G20
LK304	G20
LK305	D20
LK306	G22
LK307	E26
LK308	D25
LK309	F18
LK310	K13
LK311	N15
LK312	O14
LK313	O15
LK314	O20
LK315	Q8
LK316	P7
LK317	H18
LK318	I21
LK319	I22
LK320	I20

TRANSISTORS

Q1	I4
Q2	K8†
Q3	K8†
Q4	P8
Q5	P9†
Q6	O10†
Q7	O11†
Q9	O9†
Q11	O11†
Q12	P12†
Q13	O11†
Q14	K18†
Q15	K17†
Q16	L17†
Q17	L13†
Q29	P20†
Q30	C9†
Q31	D8†
Q32	H8†
Q33	H9†
Q35	D13†
Q36	D14†
Q37	D14†
Q38	D20†
Q40	H18†
Q41	G18†
Q42	G20†
Q43	I9
Q44	I9
Q45	I7†
Q46	I7†
Q47	J8†
Q48	J8†
Q49	F12†
Q50	G12†
Q51	F12†
Q52	D11†
Q53	F15†
Q54	D19†
Q55	D19†
Q56	D18†
Q57	G15†
Q58	G15†
Q59	G17†
Q61	H19†
Q62	G16†
Q63	M17†
Q64	J17†
Q65	M15†
Q72	O10†
Q73	P7
Q74	K13†
Q75	K13†
Q76	I10†
Q77	I10†
Q78	P15
Q98	H15†
Q100	H15†
Q101	N17†
Q102	F12†
Q103	K12†
Q104	G26†
Q105	N16†
Q107	H19†
Q108	H18†
Q109	D15†
Q110	Q27†
Q111	Q26†
Q112	E21†
Q113	E20†
Q114	P12
Q115	Q12†
Q116	I21†
Q117	H16†
Q118	H16†

RESISTORS

R1	C4
R2	G2†
R3	G3†
R4	G2†
R5	H5
R6	G2†
R7	H3
R8	H4
R9	H5
R9A	H5
R10	H5†
R11	M3†
R12	M3†
R13	M4†
R14	D19†
R15	K8†
R16	K8†
R17	K9†
R18	H15†
R19	M8†
R20	N4†
R22	P11†
R23	P10†
R24	Q11†
R25	O9†
R26	P9
R27	P9†
R28	N9†
R29	O10†
R30	O10†
R31	P10†
R32	N7
R33	O7
R34	P9†
R35	O9†
R36	Q19†
R37	O9†
R38	P8†
R39	Q15†
R40	J6
R44	O12†
R45	O12†
R46	O12†
R47	N11†
R48	P12†
R49	O11†
R50	O11†
R51	P10†
R52	P11†
R53	P11†
R55	P11†
R60	P12†
R61	O11†
R62	K20†
R63	K18†
R64	K18†
R65	L18†
R66	L17†
R67	L18†
R68	L18†
R69	L18†
R70	M24†
R71	M24†
R72	L20†
R73	L24†
R74	L24†
R75	K24†
R76	P21†
R77	P21†
R78	O21†
R79	O21†
R80	O21†
R81	O21†
R82	O21†
R83	N21†
R85	K13†
R86	L13†
R87	B11†
R88	P21†
R89	P21†
R90	P23†
R91	O23†
R92	L22†
R93	M22†
R94	M22†
R95	P24†
R96	P24†
R97	P24†
R98	P24†
R99	N22†
R100	M22†
R101	N22†
R102	P22†
R103	Q11†
R104	P11†
R105	P13†
R106	Q12†
R108	D14†
R109	D14†
R110	I2
R111	I20†
R112	I19†
R113	C16†
R114	B16†
R115	P4
R150	H17†
R151	H7†
R154	O24†
R155	O24†
R156	P20†
R157	D9†
R158	C9†
R159	C9†
R160	C9†
R161	B9†
R162	C8†
R163	B8†
R164	B8†
R165	B9†
R166	C9†
R167	C8†
R168	C8†
R169	D8†
R170	D8†
R171	D8†
R172	C8†
R173	C8†
R174	D7†
R175	C7†
R176	C7†
R177	B7†
R178	C7†
R179	C7†
R180	D7†
R181	G7†
R182	E7†
R183	E7†
R184	E8†
R186	F7†
R187	F7†
R188	D9†
R189	E7†
R190	G7†
R191	H8†
R192	G9†
R194	E7†
R195	G7†
R196	E9†
R197	E9†
R198	H7†
R199	H7†
R201	H8†
R203	I8†
R204	H9†
R205	H9†
R206	M18†
R207	M19†
R208	M19†
R210	E25
R211	E23†
R212	F23†
R215	G23†
R216	H22†
R217	C12†
R220	D13†
R222	D15†
R223	D15†
R224	C16†
R227	B12†
R228	C12†
R229	C17†
R230	C17†
R233	D14†
R236	D14†
R237	D14†
R238	D15†
R239	C21†
R240	D20†
R243	E19†
R244	F20†
R245	D21†
R246	D20†
R247	D20†
R250	C24†
R251	B22†
R252	B21†
R255	C24†
R256	G19†
R257	G18†
R258	H18†
R259	H18†
R260	G19†
R261	G19†
R262	H19†
R263	G20†
R264	G20†
R265	G19†
R269	I8†
R270	I8†
R271	I8
R272	I8
R273	C11†
R274	I7†
R275	I7†
R276	J8†
R277	J8†
R278	J8†
R279	J9†
R280	J9†
R281	E12†
R282	G11†
R283	E12†
R284	G12†
R285	G12†
R286	F12†
R287	F12†
R288	F12†
R289	F12†
R290	F13†
R291	O17†
R292	O17†
R293	P17†
R294	O17†
R295	N18†
R296	N17†
R297	O18†
R298	O18†
R299	O18†
R300	O19†
R301	O17†
R304	H13†
R305	G13†
R306	G13†
R307	H14†
R308	H14†
R309	G13†
R310	H13†
R311	G13†
R312	D12†
R313	D12†
R314	H9†
R315	E12†
R316	E11†
R317	E11†
R318	E11†
R319	G14†
R320	F15†
R321	F16†
R322	G15†
R323	E19†
R324	D19†
R325	D19†
R326	D20†
R327	E19†
R328	C17†
R329	D18†
R330	D19†
R331	D20†
R332	G15†
R333	G16†
R334	G15†
R335	F16†
R336	G17†
R337	G16†
R339	H15†
R340	H15†
R342	H19†
R343	I18†
R345	H16†
R346	G17†
R347	N17†
R348	M17†
R349	M16†
R350	K16†
R351	K16†
R352	K17†
R353	L16†
R354	Q18†
R355	L16†
R356	K15†
R357	K14†
R358	K15†
R359	J15†
R360	K16†
R361	L17†
R362	M14†
R363	M15†
R364	M15†
R365	Q8
R367	J5
R368	I4†
R369	G3†
R379	D15†
R380	D26†
R382	C24†
R383	M14†
R385	P21†
R396	D25†
R397	E25†
R398	D22†
R399	D22†
R400	G14†
R401	F14†
R402	D13†
R404	Q12†
R407	M23†
R411	N24†
R413	M24†
R414	M24†
R416	P22†
R417	J21†
R419	P11†
R420	M16†
R421	G18†
R422	K13†
R423	L13†
R424	K13†
R425	K13†
R426	K10†
R427	I11†
R428	J10†
R429	M3†
R430	N14†
R431	L9†
R432	L9†
R433	D22†
R434	C24†
R435	D16†
R436	E17†
R437	L19†
R440	L24†
R442	P16†
R443	P16†
R444	O15†
R445	P15†
R446	P18†
R450	P26†
R506	L20†
R512	N12†
R515	M11†
R518	B16†
R519	O24†
R520	M6
R521	D14†
R523	P15†
R524	P24†
R526	O22†
R527	K20†
R528	L23†
R529	N23†
R530	N23†
R532	N23†
R533	N23†
R534	L19†
R535	L18†
R536	P21†
R537	Q22†
R538	Q23†
R539	H15†
R541	M17†
R542	M17†
R543	C23†
R544	C25†
R545	P10†
R546	G11†
R547	G12†
R548	G12†
R554	K11†
R555	K12†
R556	K12†
R559	J26†
R560	K10†
R561	I10†
R562	B13†
R563	C12†
R567	C16†
R568	C16†
R569	C16†
R572	L23†
R573	M22†
R574	F15†
R575	F15†
R576	E10†
R577	E10†
R578	C10†
R579	D10†
R580	D10†
R581	D11†
R590	I24†
R592	E18†
R594	H5
R594A	H5
R595	Q18†
R596	Q10†
R598	J11†
R599	J10†
R600	J12†
R601	K11†
R602	L11†
R603	M13†
R606	L10†
R607	N10†
R612	K8†
R613	J17†
R616	M11†
R617	M11†
R618	N12†
R619	N12†
R620	M12†
R621	P7†
R625	E20†
R626	E19†
R627	M23†
R628	M23†
R629	M22†
R630	M23†
R631	D21†
R632	D20†
R633	L11†
R634	D13†
R635	M18†
R636	I13†
R637	H23†
R639	G22†
R640	H22†
R641	H22†
R642	F23†
R643	H22†
R644	G22†
R645A	Q11
R645	Q11
R646	G27†
R647	H26†
R648	H26†
R649	G26†
R650	H27†
R651	F8†
R652	G27†
R653	K10†
R655	N7†
R656	E19†
R657	O13†
R658	N13†
R659	N13†
R660	J11†
R661	K12†
R662	K12†
R663	K12†
R665	K12†
R666	K12†
R667	G19†
R668	G22†
R671	I19†
R673	P19†
R674	P19†
R675	P19†
R676	M20†
R677	K26†
R680	J10†
R681	K9†
R682	L10†
R684	E27†
R700	E9†
R703	L20†
R704	L17†
R705	O16†
R706	N18†
R707	N18†
R708	M18†
R709	J11†
R710	H4
R710A	H4
R711	H4
R711A	H4
R712	P15†
R713	J15†
R714	C18†
R715	C17†
R716	H20†
R720	L15†
R721	L15†
R722	K10†
R723	Q16†
R724	Q14†
R725	Q16†
R727	G17†
R728	H17†
R729	G17†
R730	I19†
R731	I19†
R732	H18†
R733	H18†
R734	Q11
R735	C13†
R738	D15†
R740	Q27†
R741	Q27†
R742	Q27†
R743	Q26†
R745	N2
R746	O15†
R747	E10†
R748	E21†
R749	C21†
R751	C10†
R752	C10†
R754	P12†
R755	C26†
R758	D26†
R759	D26†
R760	B23†
R761	E23†
R763	P20†

GRID REFS - IDENT DIAGRAMS FOR MAIN PCB (cont.)

R764	L11†
R765	G19†
R766	D15†
R767	L11†
R768	M11†
R769	M12†
R771	L12†
R772	N15†
R773	O14†
R774	N14†
R775	C14†
R776	C15†
R777	G20†
R778	G20†
R780	M26†
R781	E24†
R782	E24†
R784	B26†
R785	C26†
R787	N13†
R788	C10†
R789	I16†
R790	J12†
R791	J11†
R792	B26†
R793	C26†
R794	F19†
R795	D13†
R797	K9†
R798	L10†
R799	I7†
R800	L19†
R801	B25†
R802	C18†
R803	G2†
R804	H5†
R805	Q8†
R806	Q8†
R807	Q8†
R810	I26†
R811	L26†
R812	F23†
R813	N19†
R818	H20†
R819	H21†
R820	I24†
R821	F18†
R822	L12†
R823	N3†
R824	H16†
R825	G16†
R826	H16†
R827	G16†
R828	H15†
R829	H16†
R830	M19†

CONNECTORS

SK1	B2
PL1	C27
SK2	B14
PL2	O13
SK3	B19
PL3	O14
PL4	L26
SK4	B24
PL5	N3
PL7	O26
PL10	O8
PL11	J11
PL12	P12
PL26	J23
PL27	O20
PL30	D15
PL33	I17
PL35	M13
PL38	N2

ICS

U1	G3
REG1	N7
U2	L2
U3	P10
U5	L21
U6	K24
U7	P18
U8	P22
U9	O24
U15	E8
U16	G9
U17	M18
U18	G24
U19	H22
U20	E20
U21	H20
U22	L12
U25	K10
U26	G14
U27	L10
U29	K16
U30	H21
U31	L9
U32	P16

MISC. COMPONENTS

CAN	N22
E1	O17
E2	G8
FS1	C4
FS2	P4
HS1	O4
J1	D24
J2	G22
J3	F22
J4	D24
J5	O13
M20	R3
MAC1	L12
MAC2	N12
MAC3	J17
MAC4	I17
MAC5	J17
MAC6	G11
MAC7	G11
MAC8	G23
MOD1	D8
PSU1	R6
PSU2	N3
S1	M18
S2	I26
T1	D5
T3	L4
T4	L4
TST1	P22
TST2	N24
TST3	K17
TUNER1	D11
X1	L23
X2	I25
X3	M10
X4	P18
X5	K15
X6	J26
X7	F17

Notes: (i) T4 is a substitute transformer for T3 in some instances (different pitch)
(ii) M20 is the source of audio ground

GRID REFS - IDENT DIAGRAMS FOR DISPLAY PCB

* = not fitted
† = mounted on copper (SMD) side of PCB

CAPACITORS

C1	C6
C2	C6
C3	C6†
C4	C6†
C5	C6
C6	C6†
C7	C6†
C8	C6†
C10	C6†
C11	C6
C12	C6
C14	C6†
C15	C6†
C16	C6†
C17	C6†
C18	C6
C19	C6†
C20	C6†
C21	C6†
C22	C6
C23	C6†
C24	C6†

DIODES

D1	C6†
D2	C6†
D3	C6†
D4	C6†
D5	C6
D6	C6†
D7	C6†

INDUCTORS

L1	B6

LINKS

LK1	C6
LK3	C6
LK4	C6
LK5	C6
LK6	C6
LK8	C6
LK9	C6
LK10	C6
LK11	C6
LK12	C6
LK13	C6
LK14	C6
LK15	C6
LK16	C6
LK17	C6
LK18	C6
LK19	C6
LK20	C6
LK21	C6
LK22	C6
LK23	C6
LK24	C6
LK25	C6
LK26	C6
LK27	C6
LK28	C6
LK29	C6
LK30	C6
LK31	C6
LK32	C6
LK33	C6
LK34	C6
LK35	C6
LK36	C6
LK37	C6
LK38	C6
LK39	C6
LK40	C6
LK41	C6
LK42	C6
LK43	C6
LK44	C6
LK45	C6
LK46	C6
LK47	C6
LK48	C6
LK49	C6
LK50	C6†
LK51	C6†
LK52	C6†
LK53	C6†
LK54	C6†
LK55	C6†
LK56	C6†
LK58	C6†
LK59	C6†
LK60	C6†
LK61	C6†
LK62	C6†
LK63	C6†
LK64	C6
LK65	C6†
LK66	C6†
LK67	C6†
LK68	C6†

TRANSISTORS

Q1	C6†
Q2	C6†
Q3	C6†
Q4	C6†
Q5	C6
Q6	C6
Q7	C6†
Q8	C6†
Q9	C6†
Q10	C6†
Q11	C6†
Q12	C6†

RESISTORS

R1	C6†
R2	C6†
R3	C6†
R4	C6†
R5	C6†
R6	C6†
R7	C6†
R8	C6†
R9	C6†
R10	C6†
R13	C6†
R14	C6†
R15	C6†
R16	C6†
R17	C6†
R18	C6†
R19	C6†
R20	C6†
R21	C6†
R22	C6†
R23	C6†
R24	C6†
R25	C6†
R26	C6†
R27	C6†
R29	C6†
R30	C6†
R31	C6†
R32	C6†
R33	C6†
R34	C6†
R38	D6
R39	C6†
R40	C6†
R41	C6†
R42	C6†
R43	C6†
R44	C6†
R45	C6†

CONNECTORS

PL1	C6
PL2	C6
PL3	C6

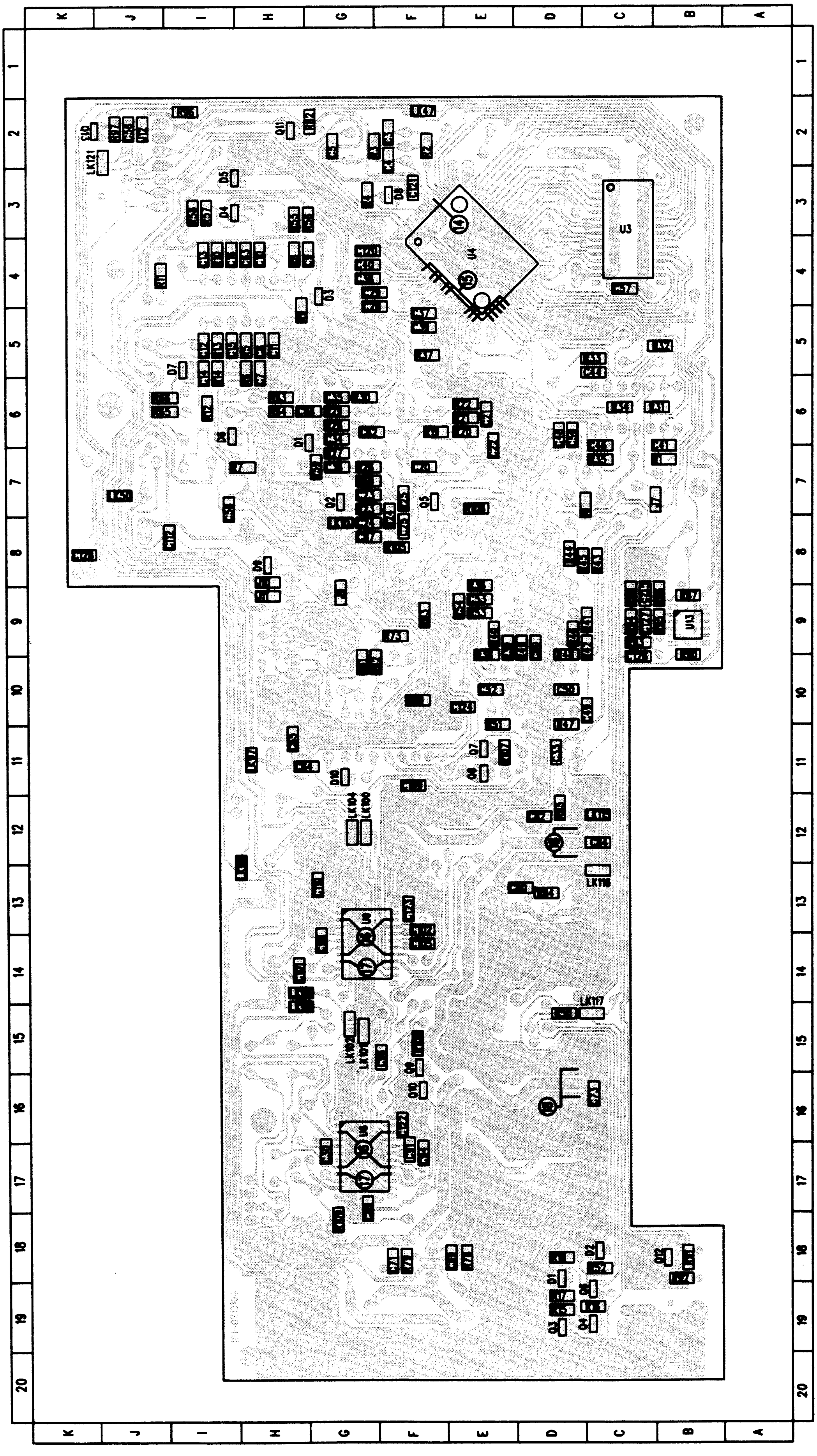
ICS

U1	B4

MISC. COMPONENTS

IR1	C6
J1	C6†
J2	C6†
LED1	C6
LED2	C6
LED3	C6
SW1	C6
SW2	C6
SW3	C6
SW4	C6
SW5	C6
VFD1	C6
X1	C6

COMPONENT IDENT SIDE OF PCB


K
J
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H
G
F
E
D
C
B
A
1
2
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5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
U3
U4
U13
LK121
LK104
LK100
LK116
LK117
LK102
LK101
D1
D2
D3
D4
D5
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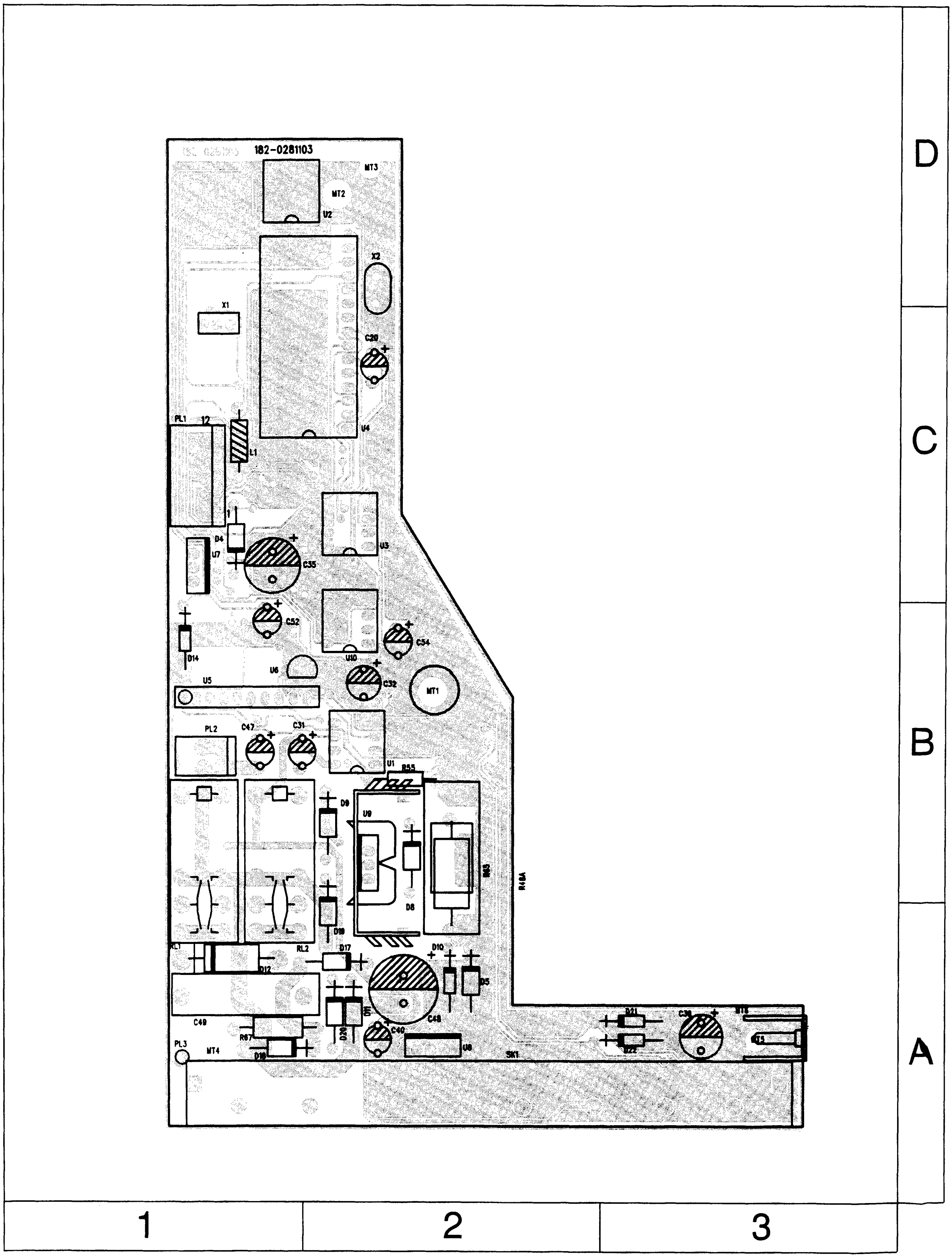
Q1
Q2
Q5
Q7
Q8
Q10
Q11
Q12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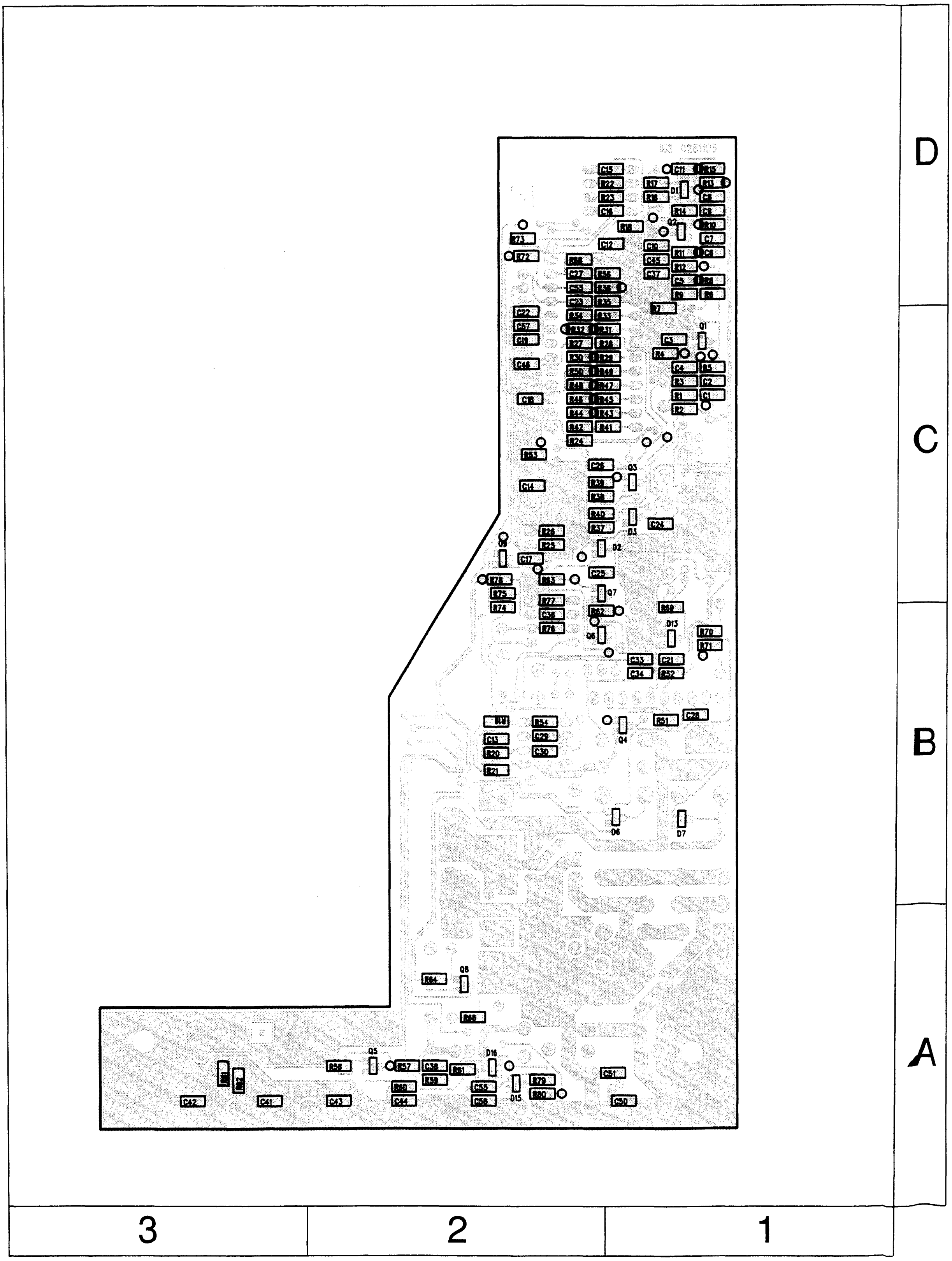
D14
U6
U10
C32
MT1
U5
PL2
C47
C31
U1
R55
D9
U9
R63
R48A
D8
D19
RL1
RL2
D17
D10
D12
D5
C49
C48
R67
D20
D11
C40
U8
PL3
MT4
D18
SK1
D21
D22
C39
D
C
B
A
1
2
3

SURFACE MOUNT SIDE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C
B
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3
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1
C15
R22
R23
C16
C11
R15
R17
R18
D1
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R14
C8
R19
Q2
R10
C12
C10
C7
R73
R72
C45
R11
C6
R12
C57
C5
R9
R8
C27
C53
C23
R7
C22
C67
C19
Q1
C3
R6
C4
R5
R3
C2
C46
R1
C1
R2
C18
R24
R41
R63
C26
Q3
C14
D3
C24
R26
R25
D2
Q9
C17
C25
R78
R75
R74
R83
R77
C36
R76
Q7
R62
R69
D13
Q6
R70
R71
C33
C21
C34
R52
R54
C29
C30
C13
R20
R21
Q4
R51
C28
D6
D7
R84
Q8
R88
Q5
R58
R57
C38
R59
R81
R60
C44
D16
D15
C55
C56
R79
R80
C61
C50
C42
C41
C43
R61
R62

COMPONENT SIDE

GRID REFS FOR POSITIONER BOARD IDENT DIAGRAMS

CAPACITORS

C1†	C3
C2†	C3
C3†	D3
C4†	C3
C5†	D3
C6†	D3
C7†	D3
C8†	D3
C9†	D3
C10†	D3
C11†	D3
C12†*	D3
C13†	B2
C14†	C2
C15†	D3
C16†	D3
C17†	C2
C18†	C2
C19†	D2
C20	D2
C21†	B3
C22†	D2
C23†	D3
C24†	C3
C25†	C3
C26†	C3
C27†	D3
C28†	B3
C29†	B3
C30†	B3
C31	B3
C32	B2
C33†	B3
C34†	B3
C35	C3
C36†	C3
C37†	D3
C38†	A2
C39	A1
C40	A2
C41†	A1
C42†	A1
C43†	A2
C44†	A2
C45†	D3
C46†	D2
C47	B3
C48	A2
C49	A2
C50†	A3
C51†	A3
C52	C3
C53†	D3
C54	C2
C55†	A2
C56†	A2

DIODES

D1†	D3
D2†	C3
D3†	C3
D4	C3
D5	A2
D6†	B3
D7†	B3
D8	B2
D9	B3
D10	A2
D11	A3
D12	A3
D13†	C3
D14	C3
D15†	A2
D16†	A2
D17	A3
D18	A3
D19	A3
D20	A3

TRANSISTORS

Q1†	D3
Q2†	D3
Q3†	C3
Q4†	B3
Q5†	A2
Q6†	C3
Q7†	C3
Q8†	A2
Q9†	C2

RESISTORS

R1†	C3
R2†	C3
R3†	C3
R4†	D3
R5†	C3
R6†	D3
R7†	D3
R8†	D3
R9†	D3
R10†	D3
R11†	D3
R12†	D3
R13†	D3
R14†	D3
R15†	D3
R16†	D3
R17†	D3
R18†	D3
R19†	B2
R20†	B2
R21†	B2
R22†	D3
R23†	D3
R24†	C3
R25†	C3
R26†	C3
R27†	D3
R28†	D3
R29†	D3
R30†	D3
R31†	D3
R32†	D3
R33†	D3
R34†	D3
R35†	D3
R36†	D3
R37†	C3
R38†	C3
R39†	C3
R40†	C3
R41†	C3
R42†	C3
R43†	C3
R44†	C3
R45†	C3
R46†	C3
R47†	C3
R48†	C3
R49†	C3
R50†	C3
R51†	B3
R52†	B3
R53†	C2
R54†	B3
R55†	B3
R56†	D3
R57†	A2
R58†	A2
R59†	A2
R60†	A2
R61†	A2
R62†	C3
R63†	C3
R64†	A2
R65	B2
R66†	A2
R67	A3
R68†	D3
R69†	C3
R70†	C3
R71†	B3
R72†	D2
R73†	D2
R74†	C2
R75†	C2
R76†	C3
R77†	C3
R78†	C2
R79†	A3
R80†	A3

ICS

U1	B3
U2	D3
U3	C3
U4	D3
U5	B3
U6	B3
U7	C3
U8	A2
U9	B2
U10	C3

MISCELLANEOUS

L1	C3
PL1	C3
PL2	B3
PL3	A3
RL1	B3
RL2	B3
SK1	A1
X1	D3
X2	D2

* = NOT FITTED

† = SURFACE MOUNTED COMPONENT

SPARES - ELECTRICAL PARTS LIST FOR MAIN BOARD

NOTE: ⚠ indicates a safety-critical component; these must only be replaced by components of the correct type as listed in these parts lists.

Capacitors

C1	⚠*A* 100NF 250V 20% CLASS X2 CAP	159-1048780
C2	100UF 400V 20% 10MM RD/EL CAP 22X36 L	855-1079783
C3	SMD 1N0F 50V 5% CER CAP COG 0805 TR	950-1025501
C4	SMD 10NF 50V 10% CER CAP X7R 0805 TR	950-1035621
C5	10UF 50V 20% 5MM RD/EL CAP 5X11 T	855-1065751
C6	100UF 25V 20% 5MM RD/EL CAP 7X11 T	855-1072751
C7	1N0F 2KV 10% 7.5MM CER CAP(HR SER) TR	159-1029651
C8	SMD 18PF 50V 5% CER CAP COG 0805 TR	950-1805501
C9	220NF 50V 10% 5MM M/LAYER CER CAP TR	157-2245651
C10	100UF 50V 20% 5MM RD/EL CAP 8X12 T	855-1075751
C11	1500UF 35V 20% 5MM RD/EL HRL 13X40 L	856-1583750
C12	1000UF 25V 20% 5MM RD/EL HRL 13X25 L	856-1082750
C13	100UF 50V 20% 5MM RD/EL CAP 8X12 T	855-1075751
C14	10UF 50V 20% 5MM RD/EL CAP 5X11 T	855-1065751
C15	1000UF 16V 20% 5MM RD/EL CAP 10X17 TR	155-1081750
C16	SMD 100NF 25V Z% CER CAP Y5V 0805 TR	950-1042951
C18	SMD 47NF 50V 10% CER CAP X7R 0805 TR	950-4735621
C19	SMD 47NF 50V 10% CER CAP X7R 0805 TR	950-4735621
C20	SMD 47NF 50V 10% CER CAP X7R 0805 TR	950-4735621
C21	⚠*A*4N7 250V 20% CLASS Y1 CAP	159-4728781
C22	SMD 47NF 50V 10% CER CAP X7R 0805 TR	950-4735621
C24	SMD 3N3F 50V 5% CER CAP X7R 0805 TR	950-3325521
C25	SMD 3N3F 50V 5% CER CAP X7R 0805 TR	950-3325521
C27	SMD 220NF 25V Z% CER CAP Y5V 0805 TR	950-2242951
C28	SMD 100PF 50V 5% CER CAP COG 0805 TR	950-1015501
C29	SMD 10NF 50V 10% CER CAP X7R 0805 TR	950-1035621
C30	SMD 100NF 25V Z% CER CAP Y5V 0805 TR	950-1042951
C31	SMD 100NF 25V Z% CER CAP Y5V 0805 TR	950-1042951
C32	SMD 0R0 0.1W LINK 0805 TR	940-0000501
C33	SMD 22PF 50V 5% CER CAP COG 0805 TR	950-2205501
C34	SMD 22NF 50V 10% CER CAP X7R 0805 TR	950-2235621
C35	SMD 33PF 50V 5% CER CAP COG 0805 TR	950-3305501
C38	SMD 1K 0.1W 5% RES 0805 TR	940-1020501
C39	SMD 39PF 50V 5% CER CAP COG 0805 TR	950-3905501
C40	SMD 22PF 50V 5% CER CAP COG 0805 TR	950-2205501
C42	SMD 5P6F 50V C% CER CAP COG 0805 TR	950-0565301
C44	SMD 22NF 50V 10% CER CAP X7R 0805 TR	950-2235621
C45	SMD 220NF 25V Z% CER CAP Y5V 0805 TR	950-2242951
C50	SMD 330NF 25V Z% CER CAP Y5V 0805 TR	950-3342951
C51	SMD 330NF 25V Z% CER CAP Y5V 0805 TR	950-3342951
C52	SMD 150PF 50V 5% CER CAP COG 0805 TR	950-1515501
C55	SMD 56PF 50V 5% CER CAP COG 0805 TR	950-5605501
C56	SMD 27PF 50V 5% CER CAP COG 0805 TR	950-2705501
C57	SMD 56PF 50V 5% CER CAP COG 0805 TR	950-5605501
C58	SMD 12PF 50V 5% CER CAP COG 0805 TR	950-1205501
C59	SMD 12PF 50V 5% CER CAP COG 0805 TR	950-1205501
C60	SMD 220PF 50V 5% CER CAP COG 0805 TR	950-2215501
C61	SMD 4N7F 50V 10% CER CAP X7R 0805 TR	950-4725621
C62	SMD 22PF 50V 5% CER CAP COG 0805 TR	950-2205501
C63	SMD 220PF 50V 5% CER CAP COG 0805 TR	950-2215501
C64	SMD 220PF 50V 5% CER CAP COG 0805 TR	950-2215501
C65	SMD 220NF 25V Z% CER CAP Y5V 0805 TR	950-2242951
C66	SMD 220PF 50V 5% CER CAP COG 0805 TR	950-2215501
C70	SMD 4P7F 50V C% CER CAP COG 0805 TR	950-0475301
C71	SMD 4P7F 50V C% CER CAP COG 0805 TR	950-0475301
C72	SMD 1P5F 50V C% CER CAP COG 0805 TR	950-0155301
C73	SMD 1P5F 50V C% CER CAP COG 0805 TR	950-0155301
C74	SMD 1P5F 50V C% CER CAP COG 0805 TR	950-0155301
C75	SMD 1P5F 50V C% CER CAP COG 0805 TR	950-0155301
C76	SMD 12PF 50V 5% CER CAP COG 0805 TR	950-1205501
C77	SMD 100PF 50V 5% CER CAP COG 0805 TR	950-1015501
C78	SMD 1N0F 50V 5% CER CAP COG 0805 TR	950-1025501
C79	SMD 22NF 50V 10% CER CAP X7R 0805 TR	950-2235621
C80	SMD 1N0F 50V 5% CER CAP COG 0805 TR	950-1025501
C81	SMD 220NF 25V Z% CER CAP Y5V 0805 TR	950-2242951
C82	SMD 180PF 50V 5% CER CAP COG 0805 TR	950-1815501
C83	SMD 1N0F 50V 5% CER CAP COG 0805 TR	950-1015501
C86	SMD 330NF 25V Z% CER CAP Y5V 0805 TR	950-3342951
C87	SMD 1N0F 50V 5% CER CAP COG 0805 TR	950-1025501
C88	SMD 220PF 50V 5% CER CAP COG 0805 TR	950-2215501
C89	SMD 1N0F 50V 5% CER CAP COG 0805 TR	950-1025501
C90	SMD 330NF 25V Z% CER CAP Y5V 0805 TR	950-3342951
C92	SMD 1N0F 50V 5% CER CAP COG 0805 TR	950-1025501
C93	SMD 1N0F 50V 5% CER CAP COG 0805 TR	950-1025501
C94	SMD 220NF 25V Z% CER CAP Y5V 0805 TR	950-2242951
C95	SMD 330PF 50V 10% CER CAP COG 0805 TR	950-3315601
C96	SMD 150PF 50V 5% CER CAP COG 0805 TR	950-1515501
C97	SMD 100NF 25V Z% CER CAP Y5V 0805 TR	950-1042951
C98	SMD 1N0F 50V 5% CER CAP COG 0805 TR	950-1025501
C100	SMD 10NF 50V 10% CER CAP X7R 0805 TR	950-1035621
C101	22UF 35V 20% 5MM RD/EL CAP 5X11 TR	155-2263751
C102	SMD 100NF 50V Z% CER CAP Y5V 0805 TR	950-1045951
C103	1U0F 50V 20% 5MM RD/EL CAP 5X11 TR	155-1055751
C104	1U0F 50V 20% 5MM M/LAYER CER CAP TR	157-1055751
C106	SMD 1N0F 50V 5% CER CAP COG 0805 TR	950-1025501
C107	10UF 50V 20% 5MM RD/EL CAP 5X11 TR	155-1065751
C108	SMD 100NF 25V Z% CER CAP Y5V 0805 TR	950-1042951
C109	SMD 56PF 50V 5% CER CAP COG 0805 TR	950-5605501
C110	SMD 220NF 25V Z% CER CAP Y5V 0805 TR	950-2242951
C111	10UF 50V 20% 5MM RD/EL CAP 5X11 TR	155-1065751
C112	SMD 100NF 25V Z% CER CAP Y5V 0805 TR	950-1042951
C113	SMD 1P5F 50V C% CER CAP COG 0805 TR	950-0155301
C114	SMD 1P5F 50V C% CER CAP COG 0805 TR	950-0155301
C115	SMD 470PF 50V 10% CER CAP X7R 0805 TR	950-4715621
C116	SMD 470PF 50V 10% CER CAP X7R 0805 TR	950-4715621
C117	3U3F 50V 20% 5MM RD/EL CAP 5X11 TR	155-3355751
C118	SMD 100NF 25V Z% CER CAP Y5V 0805 TR	950-1042951
C119	SMD 100NF 25V Z% CER CAP Y5V 0805 TR	950-1042951
C120	SMD 1N0F 50V 5% CER CAP COG 0805 TR	950-1025501
C121	SMD 1N0F 50V 5% CER CAP COG 0805 TR	950-1025501
C122	10UF 50V 20% 5MM RD/EL CAP 5X11 T	855-1065751
C123	10UF 50V 20% 5MM RD/EL CAP 5X11 T	855-1065751
C124	SMD 1N0F 50V 5% CER CAP COG 0805 TR	950-1025501
C125	SMD 1N0F 50V 5% CER CAP COG 0805 TR	950-1025501
C126	SMD 2N2F 50V 5% CER CAP COG 0805 TR	950-2225501
C127	SMD 2N2F 50V 5% CER CAP COG 0805 TR	950-2225501
C128	10UF 50V 20% 5MM RD/EL CAP 5X11 TR	155-1065751
C130	SMD 220PF 50V 5% CER CAP COG 0805 TR	950-2215501
C131	10UF 50V 20% 5MM RD/EL CAP 5X11 TR	155-1065751
C132	10UF 50V 20% 5MM RD/EL CAP 5X11 TR	155-1065751
C133	10UF 50V 20% 5MM RD/EL CAP 5X11 TR	155-1065751
C134	10UF 50V 20% 5MM RD/EL CAP 5X11 TR	155-1065751
C135	10UF 50V 20% 5MM RD/EL CAP 5X11 TR	155-1065751
C136	10UF 50V 20% 5MM RD/EL CAP 5X11 TR	155-1065751
C137	10UF 50V 20% 5MM RD/EL CAP 5X11 TR	155-1065751
C138	10UF 50V 20% 5MM RD/EL CAP 5X11 TR	155-1065751
C139	10UF 50V 20% 5MM RD/EL CAP 5X11 TR	155-1065751
C140	10UF 50V 20% 5MM RD/EL CAP 5X11 TR	155-1065751
C141	10UF 50V 20% 5MM RD/EL CAP 5X11 TR	155-1065751
C142	10UF 50V 20% 5MM RD/EL CAP 5X11 TR	155-1065751
C143	10UF 50V 20% 5MM RD/EL CAP 5X11 TR	155-1065751
C144	10UF 50V 20% 5MM RD/EL CAP 5X11 TR	155-1065751
C145	10UF 50V 20% 5MM RD/EL CAP 5X11 TR	155-1065751
C146	10UF 50V 20% 5MM RD/EL CAP 5X11 TR	155-1065751
C147	10UF 50V 20% 5MM RD/EL CAP 5X11 TR	155-1065751
C148	SMD 100NF 25V Z% CER CAP Y5V 0805 TR	950-1042951
C149	100UF 25V 20% 5MM RD/EL CAP 7X11 TR	155-1072751
C150	SMD 47PF 50V 5% CER CAP COG 0805 TR	950-4705501

SPARES - ELECTRICAL PARTS LISTS FOR MAIN BOARD (cont.)

C151	SMD 33PF 50V 5% CER CAP COG 0805 TR	950-3305501
C153	220UF 25V 20% 5M	155-2272751
C154	SMD 100NF 25V Z% CER CAP Y5V 0805 TR	950-1042951
C158	100UF 25V 20% 5MM RD/EL CAP 7X11 TR	155-1072751
C159	SMD 100NF 25V Z% CER CAP Y5V 0805 TR	950-1042951
C160	100UF 25V 20% 5MM RD/EL CAP 7X11 TR	155-1072751
C161	10UF 50V 20% 5MM RD/EL CAP 5X11 TR	155-1065751
C162	100UF 25V 20% 5MM RD/EL CAP 7X11 TR	155-1072751
C163	SMD 39PF 50V 5% CER CAP COG 0805 TR	950-3905501
C164	SMD 100NF 25V Z% CER CAP Y5V 0805 TR	950-1042951
C165	4U7F 50V 20% 5MM RD/EL CAP 5X11 TR	155-4755751
C166	SMD 100NF 25V Z% CER CAP Y5V 0805 TR	950-1042951
C167	SMD 100NF 25V Z% CER CAP Y5V 0805 TR	950-1042951
C168	22UF 35V 20% 5MM RD/EL CAP 5X11 TR	155-2263751
C169	2U2F 50V 20% 5MM RD/EL CAP 5X11 TR	155-2255751
C170	SMD 12PF 50V 5% CER CAP COG 0805 TR	950-1205501
C171	SMD 12PF 50V 5% CER CAP COG 0805 TR	950-1205501
C172	SMD 220NF 25V Z% CER CAP Y5V 0805 TR	950-2242951
C173	10UF 50V 20% 5MM RD/EL CAP 5X11 TR	155-1065751
C174	SMD 33PF 50V 5% CER CAP COG 0805 TR	950-3305501
C175	SMD 33PF 50V 5% CER CAP COG 0805 TR	950-3305501
C176	100UF 25V 20% 5MM RD/EL CAP 7X11 TR	155-1072751
C177	470UF 16V 20% 5MM RD/EL CAP 8X12 TR	156-4771751
C178	SMD 47PF 50V 5% CER CAP COG 0805 TR	950-4705501
C179	SMD 100NF 25V Z% CER CAP Y5V 0805 TR	950-1042951
C180	SMD 390PF 50V 2% CER CAP COG 0805 TR	950-3915201
C181	SMD 390PF 50V 2% CER CAP COG 0805 TR	950-3915201
C182	SMD 100PF 50V 2% CER CAP COG 0805 TR	950-1015201
C184	100UF 25V 20% 5MM RD/EL CAP 7X11 TR	155-1072751
C185	10UF 50V 20% 5MM RD/EL CAP 5X11 TR	155-1065751
C186	10UF 50V 20% 5MM RD/EL CAP 5X11 TR	155-1065751
C187	1U0F 50V 20% 5MM M/LAYER CER CAP TR	157-1055751
C188	SMD 10NF 50V 10% CER CAP X7R 0805 TR	950-1035621
C189	SMD 82PF 50V 5% CER CAP COG 0805 TR	950-8205501
C190	SMD 56PF 50V 5% CER CAP COG 0805 TR	950-5605501
C191	SMD 56PF 50V 5% CER CAP COG 0805 TR	950-5605501
C192	SMD 180PF 50V 5% CER CAP COG 0805 TR	950-1815501
C194	470NF 63V 10% 5MM BOX POLY CAP TR	152-4746651
C196	10UF 50V 20% 5MM RD/EL CAP 5X11 TR	155-1065751
C198	10UF 50V 20% 5MM RD/EL CAP 5X11 TR	155-1065751
C199	SMD 18PF 50V 5% CER CAP COG 0805 TR	950-1805501
C200	1U0F 50V 20% 5MM M/LAYER CER CAP TR	157-1055751
C201	10UF 50V 20% 5MM RD/EL CAP 5X11 TR	155-1065751
C202	SMD 4N7F 50V 10% CER CAP X7R 0805 TR	950-4725621
C203	SMD 33NF 25V 10% CER CAP X7R 0805 TR	950-3332621
C204	4U7F 50V 20% 5MM RD/EL CAP 5X11 TR	155-4755751
C205	SMD 3N3F 50V 5% CER CAP X7R 0805 TR	950-3325521
C206	SMD 220NF 25V Z% CER CAP Y5V 0805 TR	950-2242951
C207	SMD 220NF 25V Z% CER CAP Y5V 0805 TR	950-2242951
C208	1U0F 50V 20% 5MM RD/EL CAP 5X11 TR	155-1055751
C209	SMD 220NF 25V Z% CER CAP Y5V 0805 TR	950-2242951
C210	SMD 100PF 50V 5% CER CAP COG 0805 TR	950-1015501
C211	SMD 68PF 50V 5% CER CAP COG 0805 TR	950-6805501
C212	SMD 27PF 50V 5% CER CAP COG 0805 TR	950-2705501
C213	SMD 5N6F 50V 10% CER CAP X7R 0805 TR	950-5625621
C214	SMD 5N6F 50V 10% CER CAP X7R 0805 TR	950-5625621
C215	SMD 22PF 50V 5% CER CAP COG 0805 TR	950-2205501
C216	1000UF 63V 20% 7.5MM RD/EL CAP 16X32 L	855-1086770
C217	SMD 10NF 50V 10% CER CAP X7R 0805 TR	950-1035621
C219	SMD 22PF 50V 5% CER CAP COG 0805 TR	950-2205501
C220	10UF 50V 20% 5MM RD/EL CAP 5X11 TR	155-1065751
C221	10UF 50V 20% 5MM RD/EL CAP 5X11 TR	155-1065751
C222	10UF 50V 20% 5MM RD/EL CAP 5X11 TR	155-1065751
C223	10UF 50V 20% 5MM RD/EL CAP 5X11 TR	155-1065751
C224	10UF 50V 20% 5MM RD/EL CAP 5X11 TR	155-1065751
C250	SMD 220NF 25V Z% CER CAP Y5V 0805 TR	950-2242951
C251	SMD 220NF 25V Z% CER CAP Y5V 0805 TR	950-2242951
C252	SMD 100NF 25V Z% CER CAP Y5V 0805 TR	950-1042951
C253	SMD 100NF 25V Z% CER CAP Y5V 0805 TR	950-1042951
C254	SMD 100NF 25V Z% CER CAP Y5V 0805 TR	950-1042951
C255	SMD 100NF 25V Z% CER CAP Y5V 0805 TR	950-1042951
C256	SMD 470PF 50V 10% CER CAP X7R 0805 TR	950-4715621
C257	SMD 10NF 50V 10% CER CAP X7R 0805 TR	950-1035621
C258	100UF 25V 20% 5MM RD/EL CAP 7X11 TR	155-1072751
C259	SMD 47NF 50V 10% CER CAP X7R 0805 TR	950-4735621
C260	470UF 35V 20% 5MM RD/EL CAP 10X20 L	855-4773950
C261	SMD 47NF 50V 10% CER CAP X7R 0805 TR	950-4735621
C262	10UF 50V 20% 5MM RD/EL CAP 5X11 TR	155-1065751
C263	SMD 100NF 25V Z% CER CAP Y5V 0805 TR	950-1042951
C270	SMD 3N3F 50V 5% CER CAP X7R 0805 TR	950-3325521
C273	SMD 470PF 50V 10% CER CAP X7R 0805 TR	950-4715621
C274	SMD 3N3F 50V 5% CER CAP X7R 0805 TR	950-3325521
C275	SMD 100PF 50V 5% CER CAP COG 0805 TR	950-1015501
C288	1000UF 16V 20% 5MM RD/EL CAP 10X17 TR	155-1081750
C289	100UF 25V 20% 5MM RD/EL CAP 7X11 TR	155-1072751
C291	SMD 220NF 25V Z% CER CAP Y5V 0805 TR	950-2242951
C293	10UF 50V 20% 5MM RD/EL CAP 5X11 TR	155-1065751
C294	10UF 50V 20% 5MM RD/EL CAP 5X11 TR	155-1065751
C295	⚠*A* 100NF 250V 20% CLASS X2 CAP	159-1048780
C500	SMD 220NF 25V Z% CER CAP Y5V 0805 TR	950-2242951
C501	10UF 50V 20% 5MM RD/EL CAP 5X11 TR	155-1065751
C502	1000UF 16V 20% 5MM RD/EL CAP 10X17 TR	155-1081750
C503	10UF 50V 20% 5MM RD/EL CAP 5X11 TR	155-1065751
C505	100UF 25V 20% 5MM RD/EL CAP 7X11 TR	155-1072751
C506	SMD 100NF 25V Z% CER CAP Y5V 0805 TR	950-1042951
C507	1U0F 50V 20% 5MM RD/EL CAP 5X11 TR	155-1055751
C508	SMD 100PF 50V 5% CER CAP COG 0805 TR	950-1015501
C509	1U0F 50V 20% 5MM RD/EL CAP 5X11 TR	155-1055751
C510	SMD 100PF 50V 5% CER CAP COG 0805 TR	950-1015501
C512	SMD 100NF 25V Z% CER CAP Y5V 0805 TR	950-1042951
C514	SMD 56PF 50V 5% CER CAP COG 0805 TR	950-5605501
C515	SMD 22PF 50V 5% CER CAP COG 0805 TR	950-2205501
C516	SMD 220NF 25V Z% CER CAP Y5V 0805 TR	950-2242951
C517	100UF 25V 20% 5MM RD/EL CAP 7X11 TR	155-1072751
C518	SMD 1N0F 50V 5% CER CAP COG 0805 TR	950-1025501
C519	22UF 35V 20% 5MM RD/EL CAP 5X11 TR	155-2263751
C580	SMD 15PF 50V 5% CER CAP COG 0805 TR	950-1505501
C581	10UF 50V 20% 5MM RD/EL CAP 5X11 TR	155-1065751
C582	SMD 10PF 50V 5% CER CAP COG 0805 TR	950-1005501
C583	SMD 15PF 50V 5% CER CAP COG 0805 TR	950-1505501
C584	SMD 10PF 50V 5% CER CAP COG 0805 TR	950-1005501
C586	22UF 35V 20% 5MM RD/EL CAP 5X11 TR	155-2263751
C587	1U0F 50V 20% 5MM M/LAYER CER CAP TR	157-1055751
C588	SMD 10NF 50V 10% CER CAP X7R 0805 TR	950-1035621
C589	10UF 50V 20% 5MM RD/EL CAP 5X11 T	855-1065751
C590	10UF 50V 20% 5MM RD/EL CAP 5X11 T	855-1065751
C591	1U0F 50V 20% 5MM RD/EL CAP 5X11 TR	155-1055751
C592	SMD 33PF 50V 5% CER CAP COG 0805 TR	950-3305501
C593	10UF 50V 20% 5MM RD/EL CAP 5X11 TR	155-1065751
C594	10UF 50V 20% 5MM RD/EL CAP 5X11 TR	155-1065751
C595	SMD 220NF 25V Z% CER CAP Y5V 0805 TR	950-2242951
C596	SMD 220NF 25V Z% CER CAP Y5V 0805 TR	950-2242951
C597	47UF 35V 20% 5MM RD/EL CAP 7X11 TR	155-4763751
C598	47UF 35V 20% 5MM RD/EL CAP 7X11 TR	155-4763751
C599	SMD 220NF 25V Z% CER CAP Y5V 0805 TR	950-2242951
C600	SMD 10NF 50V 10% CER CAP X7R 0805 TR	950-1035621
C601	SMD 330NF 25V Z% CER CAP Y5V 0805 TR	950-3342951
C602	SMD 100NF 25V Z% CER CAP Y5V 0805 TR	950-1042951
C603	SMD 10PF 50V 5% CER CAP COG 0805 TR	950-1005501
C604	10UF 50V 20% 5MM RD/EL CAP 5X11 TR	155-1065751
C605	SMD 100NF 25V Z% CER CAP Y5V 0805 TR	950-1042951
C606	330PF 500V 10% 5MM CER CAP(DE50-6) TR	159-3319651

SPARES - ELECTRICAL PARTS LISTS FOR MAIN BOARD (cont.)

C607	SMD 100NF 25V Z% CER CAP Y5V 0805 TR	950-1042951
C608	100UF 25V 20% 5MM RD/EL CAP 7X11 TR	155-1072751
C609	22UF 35V 20% 5MM RD/EL CAP 5X11 TR	155-2263751
C610	470UF 16V 20% 5MM RD/EL CAP 8X12 TR	156-4771751
C611	SMD 270PF 50V 5% CER CAP COG 0805 TR	950-2715501
C612	SMD 270PF 50V 5% CER CAP COG 0805 TR	950-2715501
C613	SMD 18PF 50V 5% CER CAP COG 0805 TR	950-1805501
C614	SMD 39PF 50V 5% CER CAP COG 0805 TR	950-3905501
C615	SMD 270PF 50V 5% CER CAP COG 0805 TR	950-2715501
C616	SMD 220NF 25V Z% CER CAP Y5V 0805 TR	950-2242951
C617	SMD 100NF 25V Z% CER CAP Y5V 0805 TR	950-1042951
C618	SMD 330PF 50V 5% CER CAP COG 0805 TR	950-3315501
C619	SMD 47NF 50V 10% CER CAP X7R 0805 TR	950-4735621
C620	SMD 330PF 50V 10% CER CAP COG 0805 TR	950-3315601
C621	SMD 100NF 25V Z% CER CAP Y5V 0805 TR	950-1042951
C622	SMD 100NF 25V Z% CER CAP Y5V 0805 TR	950-1042951

Diodes

D1	DIODE - 1N4007 TR	120-0400701
D2	DIODE - 1N4007 TR	120-0400701
D3	DIODE - 1N4007 TR	120-0400701
D4	DIODE - 1N4007 TR	120-0400701
D5	SMD DIODE-BAS16/DAN212KT146 SWIT SOT-23	912-0001651
D6	DIODE - RGP10K 800V FAST SWITCHING TR	120-0001001
D8	SIGNAL DIODE-1N4148 75MA 75V TR	120-0414801
D9	ZENER REFERENCE TL431 CLPRA TO92 TR	125-4310001
D10	UF5402 200V RECT DIODE TR	120-0540201
D11	DIODE-SB350 50V 3A SCHOTTKY	120-0035001
D12	UF5402 200V RECT DIODE TR	120-0540201
D13	UF5402 200V RECT DIODE TR	120-0540201
D14	SMD DIODE-BAS16/DAN212KT146 SWIT SOT-23	912-0001651
D15	TINNED COPPER WIRE LINKS 0.61MM DIA	999-1099902
D17	SMD DIODE-BAS16/DAN212KT146 SWIT SOT-23	912-0001651
D18	27V 5% 400MW ZENER DIODE TR	125-0270501
D21	4V7 5% 400MW ZENER DIODE TR	125-0047501
D22	DIODE - 1N5817 1.0A 20V SCHOTTKY TR	120-0581701
D35	SMD DIODE-BAS19/ISS250 (TE85L) SOT-23 TR	912-0001951
D36	SMD DIODE-BB515 MINI PLAST TR	912-0051501
D37	SMD DIODE-BB619 MINI PLAST (TRS)	912-0061901
D38	8V2 2% 400MW ZENER DIODE TR	125-0082201
D39	SMD DIODE-BAS16/DAN212KT146 SWIT SOT-23	912-0001651
D40	SMD DIODE-BAS19/ISS250 (TE85L) SOT-23 TR	912-0001951
D41	SMD DIODE-BAS16/DAN212KT146 SWIT SOT-23	912-0001651
D42	SMD DIODE-BAS16/DAN212KT146 SWIT SOT-23	912-0001651
D44	9V1 5% 400MW ZENER DIODE TR	125-0091501
D48	SMD DIODE-BAS16/DAN212KT146 SWIT SOT-23	912-0001651
D49	SMD DIODE-BAS16/DAN212KT146 SWIT SOT-23	912-0001651
D50	SMD DIODE-BAS16/DAN212KT146 SWIT SOT-23	912-0001651
D51	SMD DIODE-BAS16/DAN212KT146 SWIT SOT-23	912-0001651
D52	SMD DIODE-BAS16/DAN212KT146 SWIT SOT-23	912-0001651
D53	SMD DIODE-BAS16/DAN212KT146 SWIT SOT-23	912-0001651
D54	RECT DIODE 300V (FES8FT)	120-0008001
D55	SMD DIODE-BAS16/DAN212KT146 SWIT SOT-23	912-0001651
D56	UF5402 200V RECT DIODE TR	120-0540201
D57	SMD DIODE-BAS16/DAN212KT146 SWIT SOT-23	912-0001651
D62	8V2 2% 400MW ZENER DIODE TR	125-0082201
D63	SMD DIODE-BAS16/DAN212KT146 SWIT SOT-23	912-0001651
D67	5V6 5% 400MW ZENER DIODE TR	125-0056501
D68	SMD DIODE-BAS16/DAN212KT146 SWIT SOT-23	912-0001651
D69	SMD DIODE-BAS16/DAN212KT146 SWIT SOT-23	912-0001651
D71	SMD DIODE-BAS16/DAN212KT146 SWIT SOT-23	912-0001651
D72	DIODE - RGP10K 800V FAST SWITCHING TR	120-0001001

Inductors

L1	100UH 5% RADIAL INDUCTOR-1A (TDK)	131-1000500
L3	100UH 5% RADIAL INDUCTOR-1A (TDK)	131-1000500
L5	1UH 5% AXIAL INDUCTOR 0305 TR	130-0010501
L6	200NH-COIL(GOLD) AIR WOUND (PEDOKA)	134-0200080
L7	200NH-COIL(GOLD) AIR WOUND (PEDOKA)	134-0200080
L8	BALUN-BC0403RID-B (PEDOKA)	133-0040300
L9	18NH-COIL (GOLD) AIR WOUND (PEDOKA)	134-0018080
L10	18NH-COIL (GOLD) AIR WOUND (PEDOKA)	134-0018080
L11	15NH-COIL(RED)AIR WOUND(PEDOKA) (A-26MM)	134-0015091
L12	SOUND COIL 4.7UH +-3% SUMIDA HKS-999-035	133-0047051
L13	2U2H 5% AXIAL INDUCTOR TR	130-0022501
L15	15UH 5% AXIAL INDUCTOR 0305 TR	130-0150501
L16	15UH 5% AXIAL INDUCTOR 0305 TR	130-0150501
L17	22UH 10% AXIAL INDUCTOR 0305 TR	130-0220601
L18	3U3H 10% AXIAL INDUCTOR 0305 TR	130-0033601
L19	33UH 5% AXIAL INDUCTOR 0305 TR	130-0330501
L20	15UH 5% AXIAL INDUCTOR 0305 TR	130-0150501
L21	18UH 5% AXIAL INDUCTOR 0408 TR	130-0180501
L22	18UH 10% AXIAL INDUCTOR 0406 TR	130-0180611
L23	3R3 0.25W 5% CARBON FILM RES TR	140-0332501
L25	12UH 5% AXIAL INDUCTOR 0305 TR	130-0120501
L27	TINNED COPPER WIRE LINKS 0.61MM DIA	999-1099902
L28	82UH 10% AXIAL INDUCTOR (TDK) T	134-0820601
L31	18UH 10% AXIAL INDUCTOR 0406 TR	130-0180611
L35	200NH-COIL(GOLD) AIR WOUND (PEDOKA)	134-0200080
L36	200NH-COIL(GOLD) AIR WOUND (PEDOKA)	134-0200080
L39	18UH 10% AXIAL INDUCTOR 0406 TR	130-0180611
L40	18UH 10% AXIAL INDUCTOR 0406 TR	130-0180611
L41	18UH 10% AXIAL INDUCTOR 0406 TR	130-0180611
L42	18UH 10% AXIAL INDUCTOR 0406 TR	130-0180611
L43	18UH 10% AXIAL INDUCTOR 0406 TR	130-0180611
L44	18UH 10% AXIAL INDUCTOR 0406 TR	130-0180611
L45	TINNED COPPER WIRE LINKS 0.61MM DIA	999-1099902
L46	100UH 10% AXIAL INDUCTOR 0406 TR	130-1000611
L47	18UH 10% AXIAL INDUCTOR 0406 TR	130-0180611
L48	18UH 10% AXIAL INDUCTOR 0406 TR	130-0180611
L49	100UH 10% AXIAL INDUCTOR 0406 TR	130-1000611
L50	82UH 10% AXIAL INDUCTOR (TDK) T	134-0820601
L51	TINNED COPPER WIRE LINKS 0.61MM DIA	999-1099902
L52	RAD FERR BEAD(PEDOKA BL02RN2-R62T2) TR	133-0226201
L53	12UH 5% AXIAL INDUCTOR 0305 TR	130-0120501

Links

Links J1 to J4 and LK 2 to LK 320 are all:

	TINNED COPPER WIRE LINKS 0.61MM DIA	999-1099902

except

LK207	10UH 5% AXIAL INDUCTOR 0305 TR	130-0100501
LK273	2V4 5% 400MW ZENER DIODE TR	125-0024501

Note: J2 and J3 mare cut after factory testing.

Connectors

Note: for plugs see "unique " parts list at the end of the manual.

SK1	⚠*A* MAINS INLET SKT 2.5A/250V	875-0778231
SK2	SCART SOCKET-JR21A3 DOUBLE DECKER	163-4202111
SK3	SCART SOCKET-JR21A3 DOUBLE DECKER	163-4202111
SK4	PHONO SOCKET-5 WAY HORIZONTAL MOUNT	165-2000510

Transistors

Q1	N CHAN POWER MOSFET STP5N90 TO220	110-0059000
Q2	SMD TRANSISTOR-BC856B PNP SOT-23	911-1085651
Q3	SMD TRANS-BC846B/2SC2412KT146R SOT-23	911-1084651
Q4	TRANSISTOR-TIP31A NPN POWER	110-1003101
Q5	SMD TRANS-BC846B/2SC2412KT146R SOT-23	911-1084651
Q6	SMD TRANS-BC846B/2SC2412KT146R SOT-23	911-1084651
Q7	SMD TRANS-BC846B/2SC2412KT146R SOT-23	911-1084651
Q9	SMD TRANS-BC846B/2SC2412KT146R SOT-23	911-1084651
Q11	SMD TRANS-BC846B/2SC2412KT146R SOT-23	911-1084651
Q12	SMD TRANS-BC846B/2SC2412KT146R SOT-23	911-1084651
Q13	SMD TRANS-BC846B/2SC2412KT146R SOT-23	911-1084651

SPARES - ELECTRICAL PARTS LISTS FOR MAIN BOARD (cont.)

Q14	SMD TRANSISTOR-BC856B PNP SOT-23	911-1085651
Q15	SMD TRANS-BC846B/2SC2412KT146R SOT-23	911-1084651
Q16	SMD TRANSISTOR-BC856B PNP SOT-23	911-1085651
Q17	SMD TRANS-BC846B/2SC2412KT146R SOT-23	911-1084651
Q29	SMD TRANS-BC846B/2SC2412KT146R SOT-23	911-1084651
Q30	SMD TRANS NPN RF BFR193 SIEMENS SOT-23	911-0019351
Q31	SMD TRANS NPN RF BFR193 SIEMENS SOT-23	911-0019351
Q32	SMD TRANS-BC846B/2SC2412KT146R SOT-23	911-1084651
Q33	SMD TRANS-BC846B/2SC2412KT146R SOT-23	911-1084651
Q35	SMD TRANS-BC846B/2SC2412KT146R SOT-23	911-1084651
Q36	SMD N CHAN FET-ZVN3306F SOT-23	911-0330651
Q37	SMD TRANS-BC846B/2SC2412KT146R SOT-23	911-1084651
Q38	SMD TRANS-BC846B/2SC2412KT146R SOT-23	911-1084651
Q40	SMD TRANS-BC846B/2SC2412KT146R SOT-23	911-1084651
Q41	SMD TRANSISTOR-BC856B PNP SOT-23	911-1085651
Q42	SMD TRANS-BC846B/2SC2412KT146R SOT-23	911-1084651
Q43	ZPS749 PNP MED PWR (=FXT749 T092 PKG) TR	110-0074931
Q44	ZPS749 PNP MED PWR (=FXT749 T092 PKG) TR	110-0074931
Q45	SMD TRANS-BC846B/2SC2412KT146R SOT-23	911-1084651
Q46	SMD TRANS-BC846B/2SC2412KT146R SOT-23	911-1084651
Q47	SMD TRANSISTOR-BC856B PNP SOT-23	911-1085651
Q48	SMD TRANSISTOR-BC856B PNP SOT-23	911-1085651
Q49	SMD TRANS-BC846B/2SC2412KT146R SOT-23	911-1084651
Q50	SMD TRANS-BC846B/2SC2412KT146R SOT-23	911-1084651
Q51	SMD TRANS-BC846B/2SC2412KT146R SOT-23	911-1084651
Q52	SMD N CHAN FET-ZVN3306F SOT-23	911-0330651
Q53	SMD TRANSISTOR-MMBT2369A NPN SWIT SOT-23	911-0236951
Q54	SMD TRANS-BC846B/2SC2412KT146R SOT-23	911-1084651
Q55	SMD TRANSISTOR-BC856B PNP SOT-23	911-1085651
Q56	SMD TRANS-BC846B/2SC2412KT146R SOT-23	911-1084651
Q57	SMD TRANS-BC846B/2SC2412KT146R SOT-23	911-1084651
Q58	SMD TRANSISTOR-BC856B PNP SOT-23	911-1085651
Q59	SMD TRANSISTOR-BC856B PNP SOT-23	911-1085651
Q61	SMD TRANS-BC846B/2SC2412KT146R SOT-23	911-1084651
Q62	SMD TRANS-BC846B/2SC2412KT146R SOT-23	911-1084651
Q63	SMD TRANS-BC846B/2SC2412KT146R SOT-23	911-1084651
Q64	SMD TRANSISTOR-BC856B PNP SOT-23	911-1085651
Q65	SMD TRANSISTOR-MMBT2369A NPN SWIT SOT-23	911-0236951
Q72	SMD TRANS-BC846B/2SC2412KT146R SOT-23	911-1084651
Q73	ZPS749 PNP MED PWR (=FXT749 T092 PKG) TR	110-0074931
Q74	SMD TRANS-BC846B/2SC2412KT146R SOT-23	911-1084651
Q75	SMD TRANS-BC846B/2SC2412KT146R SOT-23	911-1084651
Q76	SMD TRANS-BC846B/2SC2412KT146R SOT-23	911-1084651
Q77	SMD TRANS-BC846B/2SC2412KT146R SOT-23	911-1084651
Q78	N CHAN FET-ZVN3306A TO-92 PACKAGE	110-0330601
Q98	SMD TRANSISTOR-BC856B PNP SOT-23	911-1085651
Q100	SMD TRANSISTOR-BC856B PNP SOT-23	911-1085651
Q101	SMD TRANSISTOR-BC856B PNP SOT-23	911-1085651
Q102	SMD TRANS-BC846B/2SC2412KT146R SOT-23	911-1084651
Q104	SMD TRANS NPN RF BFR193 SIEMENS SOT-23	911-0019351
Q105	SMD TRANSISTOR-BC856B PNP SOT-23	911-1085651
Q107	SMD TRANS-BC846B/2SC2412KT146R SOT-23	911-1084651
Q109	SMD TRANS-BC846B/2SC2412KT146R SOT-23	911-1084651
Q110	SMD TRANS-BC846B/2SC2412KT146R SOT-23	911-1084651
Q111	SMD TRANS-BC846B/2SC2412KT146R SOT-23	911-1084651
Q112	SMD TRANS-BC846B/2SC2412KT146R SOT-23	911-1084651
Q113	SMD TRANS-BC846B/2SC2412KT146R SOT-23	911-1084651
Q114	ZPS749 PNP MED PWR (=FXT749 T092 PKG) TR	110-0074931
Q115	SMD TRANS-BC846B/2SC2412KT146R SOT-23	911-1084651
Q116	SMD TRANS-BC846B/2SC2412KT146R SOT-23	911-1084651
Q117	SMD TRANS-BC846B/2SC2412KT146R SOT-23	911-1084651
Q118	SMD N CHAN FET-ZVN3306F SOT-23	911-0330651

Resistors

R1	6R8 7W 5% WW/CER HOR/ RES 333-07	144-0689510
R2	SMD 100K 0.1W 5% RES 0805 TR	940-1040501
R3	SMD 22K 0.1W 5% RES 0805 TR	940-2230501
R4	SMD 1K 0.1W 5% RES 0805 TR	940-1020501
R5	150K 0.25W 5% CARBON FILM RES TR	140-1542501
R6	SMD 1M 0.1W 5% RES 0805 TR	940-1050501
R7	1K 5W 10% AX/PLUG CER CASE RES H=25MM	145-1029610
R8	27R 0.25W 5% CARBON FILM RES TR	140-2702501
R9	0R75 0.5W 5% FLAMEPROOF RES 9X4 TR	148-0075551
R10	SMD 1K 0.1W 5% RES 0805 TR	940-1020501
R11	SMD 470R 0.1W 5% RES 0805 TR	940-4710501
R12	SMD 1K 0.1W 1% RES 0805 TR	940-1020101
R13	SMD 1K2 0.1W 1% RES 0805 TR	940-1220101
R14	SMD 150R 0.1W 5% RES 0805 TR	940-1510501
R15	SMD 10K 0.1W 5% RES 0805 TR	940-1030501
R16	SMD 470R 0.1W 5% RES 0805 TR	940-4710501
R17	SMD 4K7 0.1W 5% RES 0805 TR	940-4720501
R18	SMD 2K2 0.1W 5% RES 0805 TR	940-2220501
R19	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R20	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R22	SMD 10K 0.1W 5% RES 0805 TR	940-1030501
R23	SMD 22K 0.1W 5% RES 0805 TR	940-2230501
R24	SMD 4K7 0.1W 5% RES 0805 TR	940-4720501
R25	SMD 4K7 0.1W 5% RES 0805 TR	940-4720501
R26	1R5 0.25W 5% CARBON FILM RES TR	140-0152501
R27	SMD 1K 0.1W 5% RES 0805 TR	940-1020501
R28	SMD 10K 0.1W 5% RES 0805 TR	940-1030501
R29	SMD 4K7 0.1W 5% RES 0805 TR	940-4720501
R30	SMD 4K7 0.1W 5% RES 0805 TR	940-4720501
R31	SMD 11K 0.1W 1% RES 0805 TR	940-1130101
R32	1K 0.25W 1% METAL FILM RES TR	141-1022101
R33	1K 0.25W 1% METAL FILM RES TR	141-1022101
R34	SMD 2K49 0.1W 1% RES 0805 TR	940-2490191
R35	SMD 4K7 0.1W 5% RES 0805 TR	940-4720501
R36	SMD 4K7 0.1W 5% RES 0805 TR	940-4720501
R37	SMD 5K6 0.1W 1% RES 0805 TR	940-5620101
R38	SMD 180R 0.1W 5% RES 0805 TR	940-1810501
R39	SMD 4K7 0.1W 5% RES 0805 TR	940-4720501
R44	SMD 1K 0.1W 5% RES 0805 TR	940-1020501
R45	SMD 1K 0.1W 5% RES 0805 TR	940-1020501
R46	SMD 11K 0.1W 1% RES 0805 TR	940-1130101
R47	SMD 11K 0.1W 1% RES 0805 TR	940-1130101
R48	SMD 2K2 0.1W 5% RES 0805 TR	940-2220501
R49	SMD 10K 0.1W 5% RES 0805 TR	940-1030501
R50	SMD 10K 0.1W 5% RES 0805 TR	940-1030501
R51	SMD 4K7 0.1W 5% RES 0805 TR	940-4720501
R52	SMD 5K6 0.1W 5% RES 0805 TR	940-5620501
R53	SMD 1K 0.1W 5% RES 0805 TR	940-1020501
R55	SMD 1K 0.1W 5% RES 0805 TR	940-1020501
R60	SMD 10R 0.1W 5% RES 0805 TR	940-1000501
R61	SMD 10K 0.1W 5% RES 0805 TR	940-1030501
R62	SMD 330R 0.1W 5% RES 0805 TR	940-3310501
R63	SMD 390R 0.1W 5% RES 0805 TR	940-3910501
R64	SMD 120R 0.1W 5% RES 0805 TR	940-1210501
R65	SMD 2K2 0.1W 1% RES 0805 TR	940-2220101
R66	SMD 1K 0.1W 5% RES 0805 TR	940-1020501
R67	SMD 220R 0.1W 5% RES 0805 TR	940-2210501
R68	SMD 330R 0.1W 5% RES 0805 TR	940-3310501
R69	SMD 560R 0.1W 5% RES 0805 TR	940-5610501
R70	SMD 10K 0.1W 5% RES 0805 TR	940-1030501
R71	SMD 10K 0.1W 5% RES 0805 TR	940-1030501
R72	SMD 100R 0.1W 5% RES 0805 TR	940-1010501
R73	SMD 4K7 0.1W 5% RES 0805 TR	940-4720501
R74	SMD 33K 0.1W 5% RES 0805 TR	940-3330501
R75	SMD 1K5 0.1W 5% RES 0805 TR	940-1520501
R76	SMD 56R 0.1W 5% RES 0805 TR	940-5600501
R77	SMD 56R 0.1W 5% RES 0805 TR	940-5600501
R78	SMD 56R 0.1W 5% RES 0805 TR	940-5600501

SPARES - ELECTRICAL PARTS LISTS FOR MAIN BOARD (cont.)

R79	SMD 56R 0.1W 5% RES 0805 TR	940-5600501
R80	SMD 56R 0.1W 5% RES 0805 TR	940-5600501
R81	SMD 56R 0.1W 5% RES 0805 TR	940-5600501
R82	SMD 56R 0.1W 5% RES 0805 TR	940-5600501
R83	SMD 56R 0.1W 5% RES 0805 TR	940-5600501
R85	SMD 4K7 0.1W 5% RES 0805 TR	940-4720501
R86	SMD 4K7 0.1W 5% RES 0805 TR	940-4720501
R87	SMD 6K8 0.1W 5% RES 0805 TR	940-6820501
R88	SMD 10K 0.1W 5% RES 0805 TR	940-1030501
R89	SMD 10K 0.1W 5% RES 0805 TR	940-1030501
R90	SMD 10K 0.1W 5% RES 0805 TR	940-1030501
R91	SMD 10K 0.1W 5% RES 0805 TR	940-1030501
R92	SMD 1M 0.1W 5% RES 0805 TR	940-1050501
R93	SMD 100R 0.1W 5% RES 0805 TR	940-1010501
R94	SMD 100R 0.1W 5% RES 0805 TR	940-1010501
R95	SMD 10K 0.1W 5% RES 0805 TR	940-1030501
R96	SMD 10K 0.1W 5% RES 0805 TR	940-1030501
R97	SMD 10K 0.1W 5% RES 0805 TR	940-1030501
R98	SMD 10K 0.1W 5% RES 0805 TR	940-1030501
R99	SMD 10K 0.1W 5% RES 0805 TR	940-1030501
R100	SMD 100R 0.1W 5% RES 0805 TR	940-1010501
R101	SMD 10K 0.1W 5% RES 0805 TR	940-1030501
R102	SMD 10K 0.1W 5% RES 0805 TR	940-1030501
R103	SMD 4K7 0.1W 5% RES 0805 TR	940-4720501
R104	SMD 22K 0.1W 5% RES 0805 TR	940-2230501
R105	SMD 220K 0.1W 5% RES 0805 TR	940-2240501
R106	SMD 47K 0.1W 5% RES 0805 TR	940-4730501
R108	SMD 220K 0.1W 5% RES 0805 TR	940-2240501
R109	SMD 220K 0.1W 5% RES 0805 TR	940-2240501
R110	220K 2W 5% CARBON FILM RES TR	142-2247501
R111	SMD 10K 0.1W 5% RES 0805 TR	940-1030501
R112	SMD 100K 0.1W 5% RES 0805 TR	940-1040501
R113	SMD 1K8 0.1W 5% RES 0805 TR	940-1820501
R114	SMD 1K8 0.1W 5% RES 0805 TR	940-1820501
R115	1R 1W 5% METOX NON-SPIRAL RES	143-0106521
R150	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R151	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R156	SMD 10K 0.1W 5% RES 0805 TR	940-1030501
R157	SMD INDUCTOR- 10UH 5% HIGH SRF 40MHZ	913-0100501
R158	SMD 470R 0.1W 5% RES 0805 TR	940-4710501
R159	SMD 470R 0.1W 5% RES 0805 TR	940-4710501
R160	SMD 1K2 0.1W 1% RES 0805 TR	940-1220101
R161	SMD 220R 0.1W 5% RES 0805 TR	940-2210501
R162	SMD 12R 0.1W 5% RES 0805 TR	940-1200501
R163	SMD 12R 0.1W 5% RES 0805 TR	940-1200501
R164	SMD 220R 0.1W 5% RES 0805 TR	940-2210501
R165	SMD 12R 0.1W 5% RES 0805 TR	940-1200501
R166	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R167	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R168	SMD 120R 0.1W 5% RES 0805 TR	940-1210501
R169	SMD 560R 0.1W 5% RES 0805 TR	940-5610501
R170	SMD 330R 0.1W 5% RES 0805 TR	940-3310501
R171	SMD 330R 0.1W 5% RES 0805 TR	940-3310501
R172	SMD 150R 0.1W 5% RES 0805 TR	940-1510501
R173	SMD 33R 0.1W 5% RES 0805 TR	940-3300501
R174	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R176	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R177	SMD 22R 0.1W 5% RES 0805 TR	940-2200501
R178	SMD 12R 0.1W 5% RES 0805 TR	940-1200501
R179	SMD 220R 0.1W 5% RES 0805 TR	940-2210501
R180	SMD 12R 0.1W 5% RES 0805 TR	940-1200501
R181	SMD 22K 0.1W 5% RES 0805 TR	940-2230501
R182	SMD 10K 0.1W 5% RES 0805 TR	940-1030501
R183	SMD 10K 0.1W 5% RES 0805 TR	940-1030501
R184	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R186	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R187	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R188	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R189	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R190	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R191	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R192	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R194	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R195	SMD 22K 0.1W 5% RES 0805 TR	940-2230501
R196	SMD 75R 0.1W 5% RES 0805 TR	940-7500501
R197	SMD 8K2 0.1W 5% RES 0805 TR	940-8220501
R198	SMD 10K 0.1W 5% RES 0805 TR	940-1030501
R199	SMD 1K 0.1W 5% RES 0805 TR	940-1020501
R201	SMD 2K 0.1W 5% RES 0805 TR	940-2020501
R203	SMD 10K 0.1W 5% RES 0805 TR	940-1030501
R204	SMD 2K 0.1W 5% RES 0805 TR	940-2020501
R205	SMD 10K 0.1W 5% RES 0805 TR	940-1030501
R206	SMD 1K2 0.1W 1% RES 0805 TR	940-1220101
R207	SMD 3K3 0.1W 1% RES 0805 TR	940-3320101
R208	SMD 1K2 0.1W 1% RES 0805 TR	940-1220101
R210	33R 0.5W 5% CARBON FILM RES TR	140-3305501
R211	SMD 22K 0.1W 5% RES 0805 TR	940-2230501
R212	SMD 22K 0.1W 5% RES 0805 TR	940-2230501
R215	SMD 4K7 0.1W 5% RES 0805 TR	940-4720501
R216	SMD 12K 0.1W 5% RES 0805 TR	940-1230501
R217	SMD 75R 0.1W 5% RES 0805 TR	940-7500501
R220	SMD 2K2 0.1W 5% RES 0805 TR	940-2220501
R222	SMD 4K7 0.1W 5% RES 0805 TR	940-4720501
R223	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R224	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R227	SMD 75R 0.1W 5% RES 0805 TR	940-7500501
R228	SMD 47R 0.1W 5% RES 0805 TR	940-4700501
R229	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R230	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R233	SMD 1K 0.1W 5% RES 0805 TR	940-1020501
R236	SMD 220K 0.1W 5% RES 0805 TR	940-2240501
R237	SMD 10K 0.1W 5% RES 0805 TR	940-1030501
R238	SMD 22K 0.1W 5% RES 0805 TR	940-2230501
R239	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R240	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R243	SMD 10M 0.1W 5% RES 0805 TR	940-1060501
R244	SMD 10M 0.1W 5% RES 0805 TR	940-1060501
R245	SMD 4K7 0.1W 5% RES 0805 TR	940-4720501
R246	SMD 4K7 0.1W 5% RES 0805 TR	940-4720501
R247	SMD 75R 0.1W 5% RES 0805 TR	940-7500501
R250	SMD 4K7 0.1W 5% RES 0805 TR	940-4720501
R251	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R252	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R255	SMD 470R 0.1W 5% RES 0805 TR	940-4710501
R256	SMD 220R 0.1W 5% RES 0805 TR	940-2210501
R257	SMD 220R 0.1W 5% RES 0805 TR	940-2210501
R258	SMD 1K 0.1W 5% RES 0805 TR	940-1020501
R259	SMD 2K7 0.1W 5% RES 0805 TR	940-2720501
R260	SMD 4K7 0.1W 5% RES 0805 TR	940-4720501
R261	SMD 4K7 0.1W 5% RES 0805 TR	940-4720501
R262	SMD 12K 0.1W 5% RES 0805 TR	940-1230501
R263	SMD 2K2 0.1W 1% RES 0805 TR	940-2220101
R264	SMD 10K 0.1W 5% RES 0805 TR	940-1030501
R265	SMD 2K2 0.1W 1% RES 0805 TR	940-2220101
R269	SMD 10K 0.1W 5% RES 0805 TR	940-1030501
R270	SMD 10K 0.1W 5% RES 0805 TR	940-1030501
R271	1K5 0.25W 5% CARBON FILM RES TR	140-1522501
R272	1K5 0.25W 5% CARBON FILM RES TR	140-1522501
R273	SMD 6K8 0.1W 5% RES 0805 TR	940-6820501
R274	SMD 4K7 0.1W 5% RES 0805 TR	940-4720501
R275	SMD 4K7 0.1W 5% RES 0805 TR	940-4720501
R276	SMD 330R 0.1W 5% RES 0805 TR	940-3310501

SPARES - ELECTRICAL PARTS LISTS FOR MAIN BOARD (cont.)

R277	SMD 3K3 0.1W 1% RES 0805 TR	940-3320101
R278	SMD 1K 0.1W 5% RES 0805 TR	940-1020501
R279	SMD 330R 0.1W 5% RES 0805 TR	940-3310501
R280	SMD 3K3 0.1W 1% RES 0805 TR	940-3320101
R281	SMD 10K 0.1W 5% RES 0805 TR	940-1030501
R282	SMD 15K 0.1W 5% RES 0805 TR	940-1530501
R283	SMD 1K2 0.1W 1% RES 0805 TR	940-1220101
R284	SMD 820R 0.1W 5% RES 0805 TR	940-8210501
R285	SMD 680R 0.1W 5% RES 0805 TR	940-6810501
R286	SMD 820R 0.1W 5% RES 0805 TR	940-8210501
R287	SMD 10K 0.1W 5% RES 0805 TR	940-1030501
R288	SMD 15K 0.1W 5% RES 0805 TR	940-1530501
R289	SMD 8K2 0.1W 5% RES 0805 TR	940-8220501
R290	SMD 2K2 0.1W 1% RES 0805 TR	940-2220101
R291	SMD 130R 0.1W 5% RES 0805 TR	940-1310501
R292	SMD 270R 0.1W 1% RES 0805 TR	940-2710101
R293	SMD 750R 0.1W 5% RES 0805 TR	940-7510501
R294	SMD 910R 0.1W 5% RES 0805 TR	940-9110501
R295	SMD 4K7 0.1W 5% RES 0805 TR	940-4720501
R296	SMD 750R 0.1W 5% RES 0805 TR	940-7510501
R297	SMD 2K2 0.1W 1% RES 0805 TR	940-2220101
R298	SMD 330R 0.1W 5% RES 0805 TR	940-3310501
R299	SMD 1K2 0.1W 1% RES 0805 TR	940-1220101
R300	SMD 1K 0.1W 5% RES 0805 TR	940-1020501
R301	SMD 1K 0.1W 5% RES 0805 TR	940-1020501
R304	SMD 1K 0.1W 1% RES 0805 TR	940-1020101
R305	SMD 1K 0.1W 1% RES 0805 TR	940-1020101
R306	SMD 270R 0.1W 1% RES 0805 TR	940-2710101
R307	SMD 165R 0.1W 1% RES 0805 TR	940-1650191
R308	SMD 1K1 0.1W 1% RES 0805 TR	940-1120101
R309	SMD 1K 0.1W 5% RES 0805 TR	940-1020501
R310	SMD 100K 0.1W 5% RES 0805 TR	940-1040501
R311	SMD 2K2 0.1W 1% RES 0805 TR	940-2220101
R312	SMD 51R 0.1W 5% RES 0805 TR	940-5100501
R313	SMD 51R 0.1W 5% RES 0805 TR	940-5100501
R314	SMD 2K 0.1W 5% RES 0805 TR	940-2020501
R315	SMD 2K2 0.1W 1% RES 0805 TR	940-2220101
R316	SMD 2K2 0.1W 1% RES 0805 TR	940-2220101
R317	SMD 10K 0.1W 5% RES 0805 TR	940-1030501
R318	SMD 22K 0.1W 5% RES 0805 TR	940-2230501
R319	SMD 470R 0.1W 5% RES 0805 TR	940-4710501
R320	SMD 1K 0.1W 5% RES 0805 TR	940-1020501
R321	SMD 220R 0.1W 5% RES 0805 TR	940-2210501
R322	SMD 220R 0.1W 5% RES 0805 TR	940-2210501
R323	SMD 100R 0.1W 5% RES 0805 TR	940-1010501
R324	SMD 2K7 0.1W 5% RES 0805 TR	940-2720501
R325	SMD 680R 0.1W 5% RES 0805 TR	940-6810501
R326	SMD 330R 0.1W 5% RES 0805 TR	940-3310501
R327	SMD 1K 0.1W 5% RES 0805 TR	940-1020501
R328	SMD 75R 0.1W 5% RES 0805 TR	940-7500501
R329	SMD 150R 0.1W 5% RES 0805 TR	940-1510501
R330	SMD 75R 0.1W 5% RES 0805 TR	940-7500501
R331	SMD 1K 0.1W 5% RES 0805 TR	940-1020501
R332	SMD 220R 0.1W 5% RES 0805 TR	940-2210501
R333	SMD 270R 0.1W 1% RES 0805 TR	940-2710101
R334	SMD 220R 0.1W 5% RES 0805 TR	940-2210501
R335	SMD 270R 0.1W 1% RES 0805 TR	940-2710101
R336	SMD 390R 0.1W 5% RES 0805 TR	940-3910501
R337	SMD 820R 0.1W 5% RES 0805 TR	940-8210501
R339	SMD 2K2 0.1W 5% RES 0805 TR	940-2220501
R340	SMD 5R6 0.1W 5% RES 0805 TR	940-0560501
R342	SMD 330R 0.1W 5% RES 0805 TR	940-3310501
R343	SMD 75R 0.1W 5% RES 0805 TR	940-7500501
R345	SMD 100R 0.1W 5% RES 0805 TR	940-1010501
R346	SMD 330R 0.1W 5% RES 0805 TR	940-3310501
R347	SMD 100K 0.1W 5% RES 0805 TR	940-1040501
R348	SMD 100R 0.1W 5% RES 0805 TR	940-1010501
R349	SMD 560R 0.1W 5% RES 0805 TR	940-5610501
R350	SMD 270K 0.1W 5% RES 0805 TR	940-2740501
R351	SMD 3K9 0.1W 5% RES 0805 TR	940-3920501
R352	SMD 2K7 0.1W 1% RES 0805 TR	940-2720101
R353	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R354	SMD 5K6 0.1W 1% RES 0805 TR	940-5620101
R355	SMD 3K3 0.1W 1% RES 0805 TR	940-3320101
R356	SMD 2K7 0.1W 1% RES 0805 TR	940-2720101
R357	SMD 470R 0.1W 5% RES 0805 TR	940-4710501
R358	SMD 56K 0.1W 5% RES 0805 TR	940-5630501
R359	SMD 33K 0.1W 5% RES 0805 TR	940-3330501
R360	SMD 820R 0.1W 5% RES 0805 TR	940-8210501
R361	SMD 1K 0.1W 5% RES 0805 TR	940-1020501
R362	SMD 10K 0.1W 5% RES 0805 TR	940-1030501
R363	SMD 4K7 0.1W 5% RES 0805 TR	940-4720501
R364	SMD 470R 0.1W 5% RES 0805 TR	940-4710501
R365	2K7 0.5W 5% CARBON FILM RES TR	140-2725501
R367	150K 0.25W 5% CARBON FILM RES TR	140-1542501
R368	SMD 22K 0.1W 5% RES 0805 TR	940-2230501
R369	SMD 8K2 0.1W 1% RES 0805 TR	940-8220101
R379	SMD 4K7 0.1W 5% RES 0805 TR	940-4720501
R380	SMD 4K7 0.1W 5% RES 0805 TR	940-4720501
R382	SMD 4K7 0.1W 5% RES 0805 TR	940-4720501
R383	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R385	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R396	SMD 100R 0.1W 5% RES 0805 TR	940-1010501
R397	SMD 100R 0.1W 5% RES 0805 TR	940-1010501
R398	SMD 100R 0.1W 5% RES 0805 TR	940-1010501
R399	SMD 100R 0.1W 5% RES 0805 TR	940-1010501
R400	SMD 100K 0.1W 5% RES 0805 TR	940-1040501
R401	SMD 100K 0.1W 5% RES 0805 TR	940-1040501
R402	SMD 75R 0.1W 5% RES 0805 TR	940-7500501
R404	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R407	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R411	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R413	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R414	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R416	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R417	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R419	SMD 1K 0.1W 5% RES 0805 TR	940-1020501
R420	SMD 560R 0.1W 5% RES 0805 TR	940-5610501
R421	SMD 75R 0.1W 5% RES 0805 TR	940-7500501
R422	SMD 10K 0.1W 5% RES 0805 TR	940-1030501
R424	SMD 10K 0.1W 5% RES 0805 TR	940-1030501
R425	SMD 4K7 0.1W 5% RES 0805 TR	940-4720501
R426	SMD 10K 0.1W 5% RES 0805 TR	940-1030501
R427	SMD 4K7 0.1W 5% RES 0805 TR	940-4720501
R428	SMD 10K 0.1W 5% RES 0805 TR	940-1030501
R430	SMD 1K 0.1W 5% RES 0805 TR	940-1020501
R432	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R433	SMD 100R 0.1W 5% RES 0805 TR	940-1010501
R434	SMD 100R 0.1W 5% RES 0805 TR	940-1010501
R435	SMD 100R 0.1W 5% RES 0805 TR	940-1010501
R436	SMD 100R 0.1W 5% RES 0805 TR	940-1010501
R437	SMD 1K 0.1W 5% RES 0805 TR	940-1020501
R440	SMD 10K 0.1W 5% RES 0805 TR	940-1030501
R442	SMD 1K 0.1W 5% RES 0805 TR	940-1020501
R443	SMD 4K7 0.1W 5% RES 0805 TR	940-4720501
R444	SMD 2K2 0.1W 5% RES 0805 TR	940-2220501
R445	SMD 1K 0.1W 5% RES 0805 TR	940-1020501
R446	SMD 4K7 0.1W 5% RES 0805 TR	940-4720501
R506	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R512	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R515	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R518	SMD 0R0 0.1W LINK 0805 TR	940-0000501

SPARES - ELECTRICAL PARTS LISTS FOR MAIN BOARD (cont.)

R519	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R520	100R 0.25W 5% CARBON FILM RES TR	140-1012501
R521	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R523	SMD 10K 0.1W 5% RES 0805 TR	940-1030501
R524	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R526	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R527	SMD 220NF 25V Z% CER CAP Y5V 0805 TR	950-2242951
R528	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R529	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R530	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R532	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R533	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R534	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R535	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R536	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R537	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R538	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R541	SMD 470R 0.1W 5% RES 0805 TR	940-4710501
R542	SMD 470R 0.1W 5% RES 0805 TR	940-4710501
R543	SMD 100R 0.1W 5% RES 0805 TR	940-1010501
R544	SMD 100R 0.1W 5% RES 0805 TR	940-1010501
R545	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R548	SMD 330R 0.1W 5% RES 0805 TR	940-3310501
R554	SMD 4K7 0.1W 5% RES 0805 TR	940-4720501
R559	SMD 75R 0.1W 5% RES 0805 TR	940-7500501
R560	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R561	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R562	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R563	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R567	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R568	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R569	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R572	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R573	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R574	SMD 18K 0.1W 1% RES 0805 TR	940-1830101
R575	SMD 12K 0.1W 5% RES 0805 TR	940-1230501
R576	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R577	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R578	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R579	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R580	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R581	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R590	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R592	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R594	0R75 0.5W 5% FLAMEPROOF RES 9X4 TR	148-0075551
R595	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R596	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R598	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R599	SMD 4K7 0.1W 5% RES 0805 TR	940-4720501
R601	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R603	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R606	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R607	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R612	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R613	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R616	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R617	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R618	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R619	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R620	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R621	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R625	SMD 15K 0.1W 5% RES 0805 TR	940-1530501
R626	SMD 10K 0.1W 5% RES 0805 TR	940-1030501
R628	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R630	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R631	SMD 10K 0.1W 5% RES 0805 TR	940-1030501
R632	SMD 15K 0.1W 5% RES 0805 TR	940-1530501
R633	SMD 47K 0.1W 5% RES 0805 TR	940-4730501
R634	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R635	SMD 100R 0.1W 5% RES 0805 TR	940-1010501
R636	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R639	SMD 100K 0.1W 5% RES 0805 TR	940-1040501
R640	SMD 10K 0.1W 5% RES 0805 TR	940-1030501
R641	SMD 4K7 0.1W 5% RES 0805 TR	940-4720501
R642	SMD 100K 0.1W 5% RES 0805 TR	940-1040501
R643	SMD 10K 0.1W 5% RES 0805 TR	940-1030501
R644	SMD 4K7 0.1W 5% RES 0805 TR	940-4720501
R645	220R 5W 5% CERAMIC CASED PLUGGABLE RES	144-2219500
R646	SMD 9K1 0.1W 5% RES 0805 TR	940-9120501
R647	SMD 4K7 0.1W 5% RES 0805 TR	940-4720501
R648	SMD 68R 0.1W 5% RES 0805 TR	940-6800501
R649	SMD 10K 0.1W 5% RES 0805 TR	940-1030501
R650	SMD 68R 0.1W 5% RES 0805 TR	940-6800501
R651	SMD 10K 0.1W 5% RES 0805 TR	940-1030501
R652	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R653	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R655	SMD 10K 0.1W 5% RES 0805 TR	940-1030501
R656	SMD 1K 0.1W 5% RES 0805 TR	940-1020501
R657	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R658	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R659	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R663	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R665	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R667	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R668	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R671	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R673	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R674	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R675	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R676	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R677	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R680	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R681	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R682	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R684	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R703	SMD 1K 0.1W 5% RES 0805 TR	940-1020501
R704	SMD 680R 0.1W 5% RES 0805 TR	940-6810501
R705	SMD 330R 0.1W 5% RES 0805 TR	940-3310501
R706	SMD 1K5 0.1W 5% RES 0805 TR	940-1520501
R707	SMD 3K3 0.1W 1% RES 0805 TR	940-3320101
R708	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R709	SMD 4K7 0.1W 5% RES 0805 TR	940-4720501
R710	0R75 0.5W 5% FLAMEPROOF RES 9X4 TR	148-0075551
R711	0R75 0.5W 5% FLAMEPROOF RES 9X4 TR	148-0075551
R712	SMD 470K 0.1W 5% RES 0805 TR	940-4740501
R713	SMD 47R 0.1W 5% RES 0805 TR	940-4700501
R714	SMD 22R 0.1W 5% RES 0805 TR	940-2200501
R715	SMD 22R 0.1W 5% RES 0805 TR	940-2200501
R716	SMD 220R 0.1W 5% RES 0805 TR	940-2210501
R720	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R721	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R722	SMD 4K7 0.1W 5% RES 0805 TR	940-4720501
R723	SMD 4K7 0.1W 5% RES 0805 TR	940-4720501
R724	SMD 4K7 0.1W 5% RES 0805 TR	940-4720501
R725	SMD 4K7 0.1W 5% RES 0805 TR	940-4720501
R727	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R728	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R729	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R730	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R731	SMD 330R 0.1W 5% RES 0805 TR	940-3310501
R732	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R734	390R 0.25W 5% CARBON FILM RES TR	140-3912501

SPARES - ELECTRICAL PARTS LISTS FOR MAIN BOARD (cont.)

R735	SMD 75R 0.1W 5% RES 0805 TR	940-7500501
R738	SMD 1K 0.1W 5% RES 0805 TR	940-1020501
R740	SMD 4K7 0.1W 5% RES 0805 TR	940-4720501
R741	SMD 820R 0.1W 5% RES 0805 TR	940-8210501
R742	SMD 1K 0.1W 5% RES 0805 TR	940-1020501
R743	SMD 12K 0.1W 5% RES 0805 TR	940-1230501
R745	10K 0.25W 5% CARBON FILM RES TR	140-1032501
R746	SMD 5K6 0.1W 1% RES 0805 TR	940-5620101
R747	SMD 100K 0.1W 5% RES 0805 TR	940-1040501
R748	SMD 2K2 0.1W 1% RES 0805 TR	940-2220101
R749	SMD 10K 0.1W 5% RES 0805 TR	940-1030501
R751	SMD 22R 0.1W 5% RES 0805 TR	940-2200501
R752	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R754	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R755	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R758	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R759	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R760	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R761	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R763	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R764	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R765	SMD 4K7 0.1W 5% RES 0805 TR	940-4720501
R766	SMD 220R 0.1W 5% RES 0805 TR	940-2210501
R767	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R768	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R769	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R771	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R772	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R773	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R774	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R776	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R777	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R778	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R780	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R781	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R782	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R784	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R785	SMD 10K 0.1W 5% RES 0805 TR	940-1030501
R787	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R788	SMD 22R 0.1W 5% RES 0805 TR	940-2200501
R789	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R790	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R791	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R792	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R793	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R794	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R795	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R798	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R799	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R802	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R803	SMD 470R 0.1W 5% RES 0805 TR	940-4710501
R804	SMD 10R 0.1W 5% RES 0805 TR	940-1000501
R805	SMD 180R 0.1W 5% RES 0805 TR	940-1810501
R806	SMD 180R 0.1W 5% RES 0805 TR	940-1810501
R807	SMD 180R 0.1W 5% RES 0805 TR	940-1810501
R810	SMD 18K 0.1W 1% RES 0805 TR	940-1830101
R811	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R812	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R813	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R818	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R819	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R820	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R821	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R822	SMD 47K 0.1W 5% RES 0805 TR	940-4730501
R824	SMD 2K2 0.1W 5% RES 0805 TR	940-2220501
R825	SMD 1K 0.1W 5% RES 0805 TR	940-1020501
R826	SMD 1K 0.1W 5% RES 0805 TR	940-1020501
R827	SMD 220K 0.1W 5% RES 0805 TR	940-2240501
R828	SMD 100K 0.1W 5% RES 0805 TR	940-1040501
R829	SMD 100K 0.1W 5% RES 0805 TR	940-1040501
REG1	V/REGULATOR-LM7812 +12V 1.5A TO-220	105-0781200

Integrated Circuits

U1	SWITCH MODE IC MC3842	109-0384200
U2	⚠*A*OPTO ISOLATOR 6PIN IC CNY17-2	108-0011101
U3	LM358/KA358 DUAL OP AMP LOW POWER	100-0035800
U5	PTV110 REV 2	109-0011002
U6	PTV114 (M50452A-037P MITSUBISHI)	109-0011401
U7	M50555 001P DISPLAY CONT (MISUBISHI)	109-0505551
U8	PTV112	109-0011201
U9	PTV115C	109-0011510
U15	SL5066 VIDEO MODULATOR (PLESSEY)	109-0506601
U16	SO PRESCALER MC12075 OR SL4633	109-0463301
U17	74HC4053 TRIPLE 2-CHANNEL MULTIPLEXER	102-1405300
U18	SOUND PROCESSOR MSP3400C-C6	109-0340030
U19	TL084CN QUAD BI-FET OP AMP (NON TEXAS)	100-0008410
U20	74HC4053 TRIPLE 2-CHANNEL MULTIPLEXER	102-1405300
U21	4052 MULTIPLEXER DUAL 4-CHANNEL	106-0405200
U22	8663 PROC 500/1000 (500CHL)(809-8663117)	809-8663117
U25	CD4094BCN 8 BIT SHIFT AND STORE REGISTER	106-0409400
U26	NICKY ASIC 3	109-0960103
U27	24C64 64K EE	104-0246400
U29	PTV111	109-0011101
U30	4053 MULTIPLEXER TRIPLE 2-CHANNEL	106-0405301
U31	74LS74 DUAL D TYPE EDGE TRIG. FLIP/FLOP	101-0007400
U32	74HC4053 TRIPLE 2-CHANNEL MULTIPLEXER	102-1405300

Miscellaneous Components

HS1	HEATSINK-TV216 POWERFIN (TO220)	202-0021600
HS1	KEROTHERM PAD TYPE 86/30 (14X19MM)	208-0863001
HS1	SPRING CLAMP-7701 TO220 FOR TV216 H/SINK	249-0770100
HS2	HEATSINK-TV216 POWERFIN (TO220)	202-0021600
HS2	KEROTHERM PAD TYPE 86/30 (14X19MM)	208-0863001
HS2	SPRING CLAMP-7701 TO220 FOR TV216 H/SINK	249-0770100
HS3	HEATSINK-TV216 POWERFIN (TO220)	202-0021600
HS3	KEROTHERM PAD TYPE 86/30 (14X19MM)	208-0863001
HS3	SPRING CLAMP-7701 TO220 FOR TV216 H/SINK	249-0770100
MOD 1	MODULATOR SCREENING CAN-FRAME REV I	315-0235102
MOD 1	MODULATOR SCREENING CAN-TOP REV I	315-0235001
T1	MAINS FILTER-UF2327P4-463V0R6-10 TDK	232-2327400
T3	⚠*A* TRANSFORMER (SM)	237-1000002
TC1	SMD 0R0 0.1W LINK 0805 TR	940-0000501
TST1	TEST PIN-VIDEOCRYPT	161-1000100
X1	XTAL 28MHZ HC49U 50/100/-20/30PF PAR 3RD	170-0280000
X2	XTAL 18.432MHZ HC49U 40/40/10/ 10PF PAR	170-0184320
X3	XTAL 16MHZ HC49U 50/50/-10+60 30PF PAR	170-0160000
X4	XTAL 17.734MHZ HC49U 20/30/10 10PF PAR	170-0177341
X5	RESONATOR-503KHZ TYPE CSB503F21	171-0005030
X6	CERAMIC TRAP TPS 4.43MJ	176-0044301

SPARES - ELECTRICAL PARTS LIST FOR SOUND BOARD

Capacitors

C1	47UF 16V 5MM RADIAL ELECT' CAP TR	155-4761751
C2	2200UF 16V 5MM RADIAL ELECT' CAP	155-2281750
C3	SMD 33PF 50V 5% CER COG CAP 0805 (TRS)	950-3305501
C4	SMD 33PF 50V 5% CER COG CAP 0805 (TRS)	950-3305501
C5	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C6	4.7UF 16V 5MM RADIAL ELECT' CAP TR	155-4751751
C7	SMD 1N5F 50V 10% CER X7R CAP 0805 (TRS)	950-1525621
C8	SMD 330PF 50V 5% CER COG CAP 0805 (TR)	950-3315501
C9	SMD 560PF 50V 5% CER COG CAP 0805 (TR)	950-5615501
C10	SMD 2.7NF 50V 5% CER X7R CAP 0805 (TR)	950-2725521
C11	SMD 3.9NF 50V 10% CER X7R CAP 0805 (TR)	950-3925621
C12	SMD 3.9NF 50V 10% CER X7R CAP 0805 (TR)	950-3925621
C13	SMD 2.7NF 50V 5% CER X7R CAP 0805 (TR)	950-2725521
C14	SMD 1N5F 50V 10% CER X7R CAP 0805 (TRS)	950-1525621
C15	SMD 330PF 50V 5% CER COG CAP 0805 (TR)	950-3315501
C16	SMD 560PF 50V 5% CER COG CAP 0805 (TR)	950-5615501
C17	100UF 16V 5MM RADIAL ELECT' CAP TR	155-1071751
C18	47UF 16V 5MM RADIAL ELECT' CAP TR	155-4761751
C19	47UF 16V 5MM RADIAL ELECT' CAP TR	155-4761751
C20	SMD 3.9NF 50V 10% CER X7R CAP 0805 (TR)	950-3925621
C21	SMD 1N5F 50V 10% CER X7R CAP 0805 (TRS)	950-1525621
C22	SMD 220PF 50V 5% CER COG CAP 0805 (TRS)	950-2215501
C23	SMD 3.9NF 50V 10% CER X7R CAP 0805 (TR)	950-3925621
C24	SMD 220PF 50V 5% CER COG CAP 0805 (TRS)	950-2215501
C25	SMD 1N5F 50V 10% CER X7R CAP 0805 (TRS)	950-1525621
C26	10UF 16V 5MM RADIAL ELECT' CAP TR	155-1061751
C27	10UF 16V 5MM RADIAL ELECT' CAP TR	155-1061751
C28	SMD 3.3NF 50V 5% CER X7R CAP 0805 (TRS)	950-3325521
C29	SMD 3.3NF 50V 5% CER X7R CAP 0805 (TRS)	950-3325521
C30	SMD 33NF 25V 10% CER X7R CAP 0805 (TRS)	950-3332621
C31	10UF 16V 5MM RADIAL ELECT' CAP TR	155-1061751
C33	SMD 330NF 25V 20/80% CER Y5V CAP 0805 TR	950-3342951
C34	SMD 3.9NF 50V 10% CER X7R CAP 0805 (TR)	950-3925621
C35	SMD 1N5F 50V 10% CER X7R CAP 0805 (TRS)	950-1525621
C36	SMD 220PF 50V 5% CER COG CAP 0805 (TRS)	950-2215501
C37	SMD 1NF 50V 5% CER COG CAP 0805 (TRS)	950-1025501
C38	SMD 1NF 50V 5% CER COG CAP 0805 (TRS)	950-1025501
C39	SMD 220PF 50V 5% CER COG CAP 0805 (TRS)	950-2215501
C40	SMD 220PF 50V 5% CER COG CAP 0805 (TRS)	950-2215501
C41	SMD 100PF 50V 5% CER COG CAP 0805 (TRS)	950-1015501
C42	47UF 16V 5MM RADIAL ELECT' CAP TR	155-4761751
C43	47UF 16V 5MM RADIAL ELECT' CAP TR	155-4761751
C44	SMD 100PF 50V 5% CER COG CAP 0805 (TRS)	950-1015501
C45	47UF 16V 5MM RADIAL ELECT' CAP TR	155-4761751
C46	SMD 100PF 50V 5% CER COG CAP 0805 (TRS)	950-1015501
C47	47UF 16V 5MM RADIAL ELECT' CAP TR	155-4761751
C48	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C49	SMD 100PF 50V 5% CER COG CAP 0805 (TRS)	950-1015501
C50	SMD 100PF 50V 5% CER COG CAP 0805 (TRS)	950-1015501
C51	10UF 16V 5MM RADIAL ELECT' CAP TR	155-1061751
C52	SMD 100PF 50V 5% CER COG CAP 0805 (TRS)	950-1015501
C53	SMD 150NF 25V 20/80% CER Y5V CAP 0805 TR	950-1542951
C54	10UF 16V 5MM RADIAL ELECT' CAP TR	155-1061751
C56	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C57	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C58	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C59	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C60	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C61	2200UF 16V 5MM RADIAL ELECT' CAP	950-1042951
C63	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C64	SMD 330NF 25V 20/80% CER Y5V CAP 0805 TR	950-3342951
C65	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C66	22UF 35V 20% 5MM 105DEG RAD ELEC CAP	855-2263751
C67	220UF 25V 20% 5MM 105DEG RAD ELEC CAP	855-2272751
C68	220UF 25V 20% 5MM 105DEG RAD ELEC CAP	855-2272751
C69	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C70	2200UF 25V DJ3 +-20% RADIAL ELECT' CAP	855-2282960
C71	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C72	2200UF 25V DJ3 +-20% RADIAL ELECT' CAP	855-2282960
C73	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C74	100UF 50V 20% 105DEG RADIAL ELECT'CAP TR	855-1075751
C76	10UF 16V 5MM RADIAL ELECT' CAP TR	155-1061751
C77	22UF 35V 20% 5MM 105DEG RAD ELEC CAP	855-2263751
C78	220UF 25V 20% 5MM 105DEG RAD ELEC CAP	855-2272751
C79	220UF 25V 20% 5MM 105DEG RAD ELEC CAP	855-2272751
C80	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C81	2200UF 25V DJ3 +-20% RADIAL ELECT' CAP	855-2282960
C82	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C83	2200UF 25V DJ3 +-20% RADIAL ELECT' CAP	855-2282960
C84	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C85	100UF 50V 20% 105DEG RADIAL ELECT'CAP TR	855-1075751
C86	4.7UF 50V 20% 5MM 105DEG RAD ELEC CAP	855-4755751
C87	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C88	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C89	SMD 5.6NF 50V 10% CER X7R CAP 0805 (TR)	950-5625621
C90	10UF 16V 5MM RADIAL ELECT' CAP TR	155-1061751
C91	SMD 33NF 25V 10% CER X7R CAP 0805 (TRS)	950-3332621
C93	4.7UF 50V 20% 5MM 105DEG RAD ELEC CAP	855-4755751
C94	SMD 5.6NF 50V 10% CER X7R CAP 0805 (TR)	950-5625621
C95	22UF 35V 5MM RADIAL ELECT' CAP	155-2263751
C96	SMD 330NF 25V 20/80% CER Y5V CAP 0805 TR	950-3342951
C97	100UF 16V 5MM RADIAL ELECT' CAP TR	155-1071751
C98	SMD 33NF 25V 10% CER X7R CAP 0805 (TRS)	950-3332621
C100	4.7UF 50V 20% 5MM 105DEG RAD ELEC CAP	855-4755751
C101	SMD 5.6NF 50V 10% CER X7R CAP 0805 (TR)	950-5625621
C102	SMD 33NF 25V 10% CER X7R CAP 0805 (TRS)	950-3332621
C103	4.7UF 16V 5MM RADIAL ELECT' CAP TR	155-4751751
C104	4.7UF 16V 5MM RADIAL ELECT' CAP TR	155-4751751
C105	SMD 5.6NF 50V 10% CER X7R CAP 0805 (TR)	950-5625621
C106	22UF 35V 5MM RADIAL ELECT' CAP	155-2263751
C109	SMD 330NF 25V 20/80% CER Y5V CAP 0805 TR	950-3342951
C110	SMD 330NF 25V 20/80% CER Y5V CAP 0805 TR	950-3342951
C111	2200UF 16V 5MM RADIAL ELECT' CAP	155-2281750
C112	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C120	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C121	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C122	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C123	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C124	SMD 330NF 25V 20/80% CER Y5V CAP 0805 TR	950-3342951

Diodes

D1	SMD 4V7 5% ZENER DIODE SOT-23	925-0047551
D2	SMD 4V7 5% ZENER DIODE SOT-23	925-0047551
D3	SMD DIODE-BAS16/DAN212KT146 SOT-23	912-0001651
D4	SMD DIODE-BAV99 DUAL DIODE SOT-23 TR	912-0009951
D5	SMD DIODE-BAV99 DUAL DIODE SOT-23 TR	912-0009951
D6	SMD DIODE-BAV99 DUAL DIODE SOT-23 TR	912-0009951
D7	SMD DIODE-BAV99 DUAL DIODE SOT-23 TR	912-0009951
D8	SMD DIODE-BAS16/DAN212KT146 SOT-23	912-0001651
D9	SMD DIODE-BAS19/ISS250 (TE85L) SOT-23 TR	912-0001951
D10	SMD DIODE-BAS19/ISS250 (TE85L) SOT-23 TR	912-0001951

Links

J1	TINNED COPPER WIRE LINKS 0.61MM DIA-PMF	999P1099901
J2	TINNED COPPER WIRE LINKS 0.61MM DIA-PMF	999P1099901
J4	TINNED COPPER WIRE LINKS 0.61MM DIA-PMF	999P1099901
J5	TINNED COPPER WIRE LINKS 0.61MM DIA-PMF	999P1099901
J6	TINNED COPPER WIRE LINKS 0.61MM DIA-PMF	999P1099901
J7	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501

SPARES - ELECTRICAL PARTS LISTS FOR SOUND BOARD (cont.)

Links cont.

J10	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501

LK1 to LK124 are all:

	TINNED COPPER WIRE LINKS 0.61MM DIA-PMF	999P1099901

except LK47, LK96 to LK104 and LK115 to LK117 which are:

	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501

Connectors

PL1	FE CONNECTOR - 6 WAY SIDE ENTRY JST	161-2100610
PL2	FE CONNECTOR - 9 WAY SIDE ENTRY JST	161-2100910
PL3	FE CONNECTOR - 7 WAY SIDE ENTRY JST	161-2100710
PL4	PIN HEADER-2WAY FRIC LOCK (JST B 2P-VH)	161-1000204
SK1	LOUD SPKR CONN.BLOCK 8W LQR0810-0008M	163-1081000

Transistors

Q1	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q2	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q3	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q4	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q5	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q6	SMD TRANSISTOR-BC856B SOT-23	911-1085651
Q7	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q8	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q9	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q10	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q11	SMD TRANSISTOR-BC846B SOT-23	911-1084651

Resistors

R1	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R2	SMD 100R 0.1W 5% RES 0805 (TRS)	940-1010501
R3	SMD 1M 0.1W 5% RES 0805 (TRS)	940-1050501
R4	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R5	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R6	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R7	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R8	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R9	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R10	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R11	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R12	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R13	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R14	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R15	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R16	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R17	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R18	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R19	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R20	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R21	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R22	SMD 47K 0.1W 5% RES 0805 (TRS)	940-4730501
R23	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R24	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R25	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R26	SMD 47K 0.1W 5% RES 0805 (TRS)	940-4730501
R27	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R28	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R29	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R30	SMD 47K 0.1W 5% RES 0805 (TRS)	940-4730501
R31	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R32	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R33	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R34	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R35	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R36	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R37	SMD 20R 0.1W 5% RES 0805 (TRS)	940-2000501
R38	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R39	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R40	SMD 4K7 0.1W 5% RES 0805 (TRS)	940-4720501
R41	SMD 4K7 0.1W 5% RES 0805 (TRS)	940-4720501
R42	SMD 4K7 0.1W 5% RES 0805 (TRS)	940-4720501
R43	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R44	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R45	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R46	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R47	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R48	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R49	SMD 1M 0.1W 5% RES 0805 (TRS)	940-1050501
R50	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R51	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R52	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R53	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R54	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R55	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R56	SMD 100R 0.1W 5% RES 0805 (TRS)	940-1010501
R57	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R58	SMD 100R 0.1W 5% RES 0805 (TRS)	940-1010501
R59	SMD 1K 0.1W 5% RES 0805 (TRS)	940-1020501
R60	SMD 1K 0.1W 5% RES 0805 (TRS)	940-1020501
R63	SMD 100R 0.1W 5% RES 0805 (TRS)	940-1010501
R64	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R65	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R66	SMD 100R 0.1W 5% RES 0805 (TRS)	940-1010501
R73	SMD 100K 0.1W 5% RES 0805 (TRS)	940-1040501
R78	SMD 3R9 0.1W 5% RES 0805 (TRS)	940-0390501
R79	SMD 3R9 0.1W 5% RES 0805 (TRS)	940-0390501
R82	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R83	SMD 100K 0.1W 5% RES 0805 (TRS)	940-1040501
R84	SMD 3R9 0.1W 5% RES 0805 (TRS)	940-0390501
R85	SMD 3R9 0.1W 5% RES 0805 (TRS)	940-0390501
R89	SMD 100K 0.1W 5% RES 0805 (TRS)	940-1040501
R105	SMD 4K7 0.1W 5% RES 0805 (TRS)	940-4720501
R106	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R107	SMD 1K 0.1W 5% RES 0805 (TRS)	940-1020501
R108	SMD 1K 0.1W 5% RES 0805 (TRS)	940-1020501
R109	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501

Integrated Circuits

U1	TL084 QUAD BI-FET OP AMP LOW NOISE	100-0008400
U2	HEF4053 TRIPLE 2-CHANNEL MULTIPLEXER	106-0405301
U3	SMD IC - 256K 8 BIT X 32K PS RAM 100NS	904-1025601
U4	SMD IC-DOLBY PROLOGIC PROCESSOR YSS215	909-1021501
U5	TL084 QUAD BI-FET OP AMP LOW NOISE	100-0008400
U6	TEA6330T SOUND FADER CONTROL IC (TR)	909-0633001
U7	TL084 QUAD BI-FET OP AMP LOW NOISE	100-0008400
U8	TL084 QUAD BI-FET OP AMP LOW NOISE	100-0008400
U9	TEA6330T SOUND FADER CONTROL IC (TR)	909-0633001
U10	74HC4316	102-1431600
U11	KEROTHERM PAD TYPE 86/37 (13.5X37X0.2)	208-0863701
U12	KEROTHERM PAD TYPE 86/37 (13.5X37X0.2)	208-0863701

Miscellaneous Components

X1	11.2896MHZ QUARTZ CRYSTAL	170-0112890
HS1	HEATSINK-6063 ALLOY MSS1000 SUR/SOUND	202-0606300
2 OFF	SPRING CLIP - 4597 MSS1000 AUDIO HEATSINK	249-0459700
FIT TO U11		
	KEROTHERM PAD TYPE 86/30 (14X19MM)	208-0863001
FIT TO U12		
	KEROTHERM PAD TYPE 86/30 (14X19MM)	208-0863001
3 OFF	SNAP RIVET-SR3555B BLACK PLASTIC RICHCO	247-3555111
1 OFF	COVER - VAC FORMED FOR MSS AUDIO - HI TEMP	312-1002219

SPARES - ELECTRICAL PARTS LIST FOR CARD READER BOARD

Capacitors

C1	SMD 47PF 50V 5% CER COG CAP 0805 (TRS)	950-4705501
C2	SMD 47PF 50V 5% CER COG CAP 0805 (TRS)	950-4705501
C3	SMD 0.1 UF 25V 20/80% CER COG CAP 0805 TR	950-1042951
C4	SMD 0.1 UF 25V 20/80% CER COG CAP 0805 TR	950-1042951
C5	10UF 16V 5MM RADIAL ELECT' CAP TR	155-1061751
C6	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C7	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C9	10UF 16V 5MM RADIAL ELECT' CAP TR	155-1061751
C10	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C11	SMD 47NF 50V 10% CER X7R CAP 0805 (TRS)	950-4735621
C12	SMD 10NF 50V 10% CER X7R CAP 0805 (TRS)	950-1035621
C13	SMD 10NF 50V 10% CER X7R CAP 0805 (TRS)	950-1035621
C14	SMD 10NF 50V 10% CER X7R CAP 0805 (TRS)	950-1035621
C15	SMD 47NF 50V 10% CER X7R CAP 0805 (TRS)	950-4735621

Diodes

D1	SMD DIODE-BAS16/DAN212KT146 SOT-23	912-0001651
D2	SMD DIODE-BAS16/DAN212KT146 SOT-23	912-0001651
D3	SMD DIODE-BAS16/DAN212KT146 SOT-23	912-0001651
D4	SMD DIODE-BAS16/DAN212KT146 SOT-23	912-0001651
D5	SMD DIODE-BAS16/DAN212KT146 SOT-23	912-0001651
D6	SMD DIODE-BAS16/DAN212KT146 SOT-23	912-0001651
D7	SMD DIODE-BAS16/DAN212KT146 SOT-23	912-0001651
D8	SMD DIODE-BAS16/DAN212KT146 SOT-23	912-0001651

Connectors

PL1	FE CONNECTOR -11 WAY TOP ENTRY JST	161-2001110
PL2	FE CONNECTOR - 8 WAY TOP ENTRY JST	161-2000810

Transistors

Q1	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q2	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q3	TRANSISTOR-FXT749 (ZETEX) TR	110-0074911
Q4	TRANSISTOR-FXT749 (ZETEX) TR	110-0074911
Q5	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q6	TRANSISTOR-FXT749 (ZETEX) TR	110-0074911
Q7	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q8	TRANSISTOR-FXT749 (ZETEX) TR	110-0074911

Resistors

R1	SMD 1K8 0.1W 5% RES 0805 (TRS)	940-1820501
R2	SMD 10K8 0.1W 5% RES-0805 (TRS)	940-1030501
R6	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R7	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R8	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R9	SMD 4K7 0.1W 5% RES 0805 (TRS)	940-4720501
R10	SMD 1K 0.1W 5% RES 0805 (TRS)	940-1020501
R11	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R12	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R13	SMD 4K7 0.1W 5% RES 0805 (TRS)	940-4720501
R14	SMD 1K 0.1W 5% RES 0805 (TRS)	940-1020501
R15	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R17	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R18	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R19	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R20	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R21	SMD 100K 0.1W 5% RES 0805 (TRS)	940-1040501
R22	SMD 100K 0.1W 5% RES 0805 (TRS)	940-1040501
R23	SMD 100K 0.1W 5% RES 0805 (TRS)	940-1040501
R24	SMD 100K 0.1W 5% RES 0805 (TRS)	940-1040501
R25	SMD 100K 0.1W 5% RES 0805 (TRS)	940-1040501
R26	SMD 100K 0.1W 5% RES 0805 (TRS)	940-1040501
R27	SMD 100K 0.1W 5% RES 0805 (TRS)	940-1040501
R28	SMD 100K 0.1W 5% RES 0805 (TRS)	940-1040501
R29	SMD 100K 0.1W 5% RES 0805 (TRS)	940-1040501
R30	SMD 100K 0.1W 5% RES 0805 (TRS)	940-1040501
R31	SMD 100K 0.1W 5% RES 0805 (TRS)	940-1040501
R32	SMD 100K 0.1W 5% RES 0805 (TRS)	940-1040501
R33	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R34	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R35	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R36	SMD 100K 0.1W 5% RES 0805 (TRS)	940-1040501
R37	SMD 470R 0.1W 5% RES 0805 (TRS)	940-4710501
R38	SMD 100K 0.1W 5% RES 0805 (TRS)	940-1040501
R39	SMD 470R 0.1W 5% RES 0805 (TRS)	940-4710501
R40	4R7 0.5W 1% METAL FILM RES TR	141-0475101
R41	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501

Integrated Circuits

U1	SMD IC-4053 SO-16 TR	906-0405302
U2	SMD IC-4053 SO-16 TR	906-0405302
U3	(A VIDEOCRYPT COMPONENT)	109-0011301
U4	SMD IC-74HC04 (TR)	902-2000401

Miscellaneous Components

CARD1	SMART CARD READER-ALCATEL7001LM0416T2F08	870-7001001
CARD2	SMART CARD READER-ALCATEL7001LM0416T2F08	870-7001001

SPARES - ELECTRICAL PARTS LIST FOR U22 EXTENSION BOARD

C1	1UF 50V 5MM M/LAYER CER.CAP TR	157-1055751
C2	100NF 50V 5MM M/LAYER CER.CAP TR	157-1045751
C3	100NF 50V 5MM M/LAYER CER.CAP TR	157-1045751
C4	100NF 50V 5MM M/LAYER CER.CAP TR	157-1045751
C5	33PF 100V 5MM CERAMIC CAP TR	150-3307551
C6	47PF 100V 5MM CERAMIC CAP TR	150-4707551
J1	TINNED COPPER WIRE LINKS 0.61MM DIA-PMF	999P1099901
PL 1	PIN HEADER-20 WAY EXTENDED S/ROW(SAMTEC)	161-1002002

Note: 2 of these connectors are fitted to make up PL1

U1	SMD IC-Z86C9620VSC ROMLESS Z8	904-0669601
U3	74HC374	102-1037400
FIT TO U4		
	SOCKET-28 PIN IC DIL	209-2002800
X1	XTAL 16MHZ HC18U 50/50/-10+60 30PF PAR	170-0660000
FIT TO X1		
	INS.WASHER-FOR HC18/49 (HOLED) XTAL CAN	208-0553000

SPARES - ELECTRICAL PARTS LIST FOR DISPLAY BOARD

Capacitors

C1	100UF 25V 2.5MM RADIAL ELECT' CAP	155-1072720
C2	100UF 25V 5MM RADIAL ELECT' CAP TR	155-1072751
C5	330UF 10V 2.5MM RADIAL ELECT' CAP 20%	156-3371720
C6	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C7	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C8	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C10	SMD 100NF 50V 20/80% CER Y5V CAP 0805 TR	950-1045951
C11	10UF 50V 20% 5MM MINI RAD ELECT' CAP TR	156-1065751
C12	10UF 50V 20% 5MM MINI RAD ELECT' CAP TR	156-1065751
C14	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C15	SMD 1NF 50V 5% CER COG CAP 0805 (TRS)	950-1025501
C16	SMD 1NF 50V 5% CER COG CAP 0805 (TRS)	950-1025501
C17	SMD 1NF 50V 5% CER COG CAP 0805 (TRS)	950-1025501
C18	330UF 25V 3.5MM RADIAL ELECT' CAP	155-3372730
C19	SMD 220NF 25V 20/80% CER Y5V CAP 0805 TR	950-2242951
C20	SMD 220NF 25V 20/80% CER Y5V CAP 0805 TR	950-2242951
C21	SMD 220NF 25V 20/80% CER Y5V CAP 0805 TR	950-2242951
C22	100NF 50V 5MM M/LAYER CER CAP 10% TR	157-1045651

Diodes

D1	SMD DIODE-BAR43 SOT-23 (TRS)	912-0004351
D2	SMD DIODE-BAR43 SOT-23 (TRS)	912-0004351
D3	SMD DIODE-BAR43 SOT-23 (TRS)	912-0004351
D4	SMD DIODE-BAR43 SOT-23 (TRS)	912-0004351
D5	TINNED COPPER WIRE LINKS 0.61MM DIA.(TRS	999-1099901

Inductors

L1	AXIAL INDUCTOR-18UH 10% DC RES <0.8R TR	130-0180611

Links

J1	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
J2	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
LK1 to LK49 are all:		
	TINNED COPPER WIRE LINKS 0.61MM DIA-PMF	999P1099901
LK50 to LK63 are all:		
	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501

Connectors

PL1	FE CONNECTOR - 10 WAY SIDE ENTRY JST	161-2101010
PL2 to PL3		
	CABLE ASSY-3WAY 75MM MSS DISP BOARD	266-1000030

Transistors

Q1	SMD TRANSISTOR-BC856B SOT-23	911-1085651
Q2	SMD TRANSISTOR-BC856B SOT-23	911-1085651
Q3	SMD TRANSISTOR-BC856B SOT-23	911-1085651
Q4	SMD TRANSISTOR-BC856B SOT-23	911-1085651
Q5	TRANSISTOR - ZTX749 (ZETEX) TR	110-1074911
Q6	TRANSISTOR-ZTX450 (ZETEX) TR	110-0045011
Q7	SMD TRANSISTOR-BC856B SOT-23	911-1085651
Q8	SMD TRANSISTOR-BC856B SOT-23	911-1085651
Q9	SMD TRANSISTOR-BC856B SOT-23	911-1085651
Q10	SMD TRANSISTOR-BC856B SOT-23	911-1085651

Resistors

R1	18K 0.25W 5% CARBON FILM	140-1832501
R2	1K8 0.25W 5% CARBON FILM	140-1822501
R3	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R4	SMD 1K8 0.1W 5% RES 0805 (TRS)	940-1820501
R5	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R6	SMD 1K8 0.1W 5% RES 0805 (TRS)	940-1820501
R7	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R8	SMD 1K8 0.1W 5% RES 0805 (TRS)	940-1820501
R9	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R10	SMD 1K8 0.1W 5% RES 0805 (TRS)	940-1820501
R13	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R14	SMD 1K8 0.1W 5% RES 0805 (TRS)	940-1820501
R15	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R16	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R17	SMD 47K 0.1W 5% RES 0805 (TRS)	940-4730501
R18	SMD 47K 0.1W 5% RES 0805 (TRS)	940-4730501
R19	SMD 47K 0.1W 5% RES 0805 (TRS)	940-4730501
R20	SMD 47K 0.1W 5% RES 0805 (TRS)	940-4730501
R21	SMD 47K 0.1W 5% RES 0805 (TRS)	940-4730501
R22	SMD 560R 0.1W 5% RES 0805 (TRS)	940-5610501
R23	SMD 560R 0.1W 5% RES 0805 (TRS)	940-5610501
R24	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R25	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R26	SMD 4K7 0.1W 5% RES 0805 (TRS)	940-4720501
R27	SMD 560R 0.1W 5% RES 0805 (TRS)	940-5610501
R29	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R30	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R31	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R32	SMD 470R 0.1W 5% RES 0805 (TRS)	940-4710501
R33	SMD 470R 0.1W 5% RES 0805 (TRS)	940-4710501
R34	SMD 220R 0.1W 5% RES 0805 (TRS)	940-2210501
R36	SMD 0.1W 5% ZEROHM LINK - 0805 (TRS)	940-0000501
R38	22R 1W 5% CARBON FILM RES TR	140-2206501

Switches

SW1	SWITCH - B3F1005 PCB STANDARD (TR)	204-0100502
SW2	SWITCH - B3F1005 PCB STANDARD (TR)	204-0100502
SW3	SWITCH - B3F1005 PCB STANDARD (TR)	204-0100502
SW4	SWITCH - B3F1005 PCB STANDARD (TR)	204-0100502

Integrated Circuits

U1	PANASONIC MICRO MN158418PCEM MSS1000	809-1584001

Miscellaneous Components

IR1	SONY INFRA-RED REC MODULE (SBX 1610-E2)	215-1610002
LED1	LED-GREEN 2MM TOWER TYPE 103 SERIES H/EF	200-2110201
LED2	LED-GREEN 2MM TOWER TYPE 103 SERIES H/EF	200-2110201
VFD1	VAC/FLUORESCENT DISP 11-MT-91GK ISSUE C	200-0119100
X1	RESONATOR CST 4.00 MGN TF01	171-0040000
2 OFF	LED SUPPORT CLIP MSS1000	249-1000100
1 OFF	VFD DISPLAY SUPPORT CLIP (RHS) MSS1000	249-1001100
1 OFF	VFD DISPLAY SUPPORT CLIP (LHS) MSS1000	249-1002100

SPARES - MECHANICAL PARTS LIST

Note: some mechanical parts also appear in the "Miscellaneous Components" section of the parts lists for individual boards.

1 OFF	BAG - POLYTHENE 400 X 330 FOR MSS1000 UNIT	400-4403300
1 OFF	BAG-POLYTHENE FOR LEADS	400-1080400
2 OFF	BATTERY-1.5V AAA	239-0015000
1 OFF	COMPRESSION RING FOR MSS1000 KNOB	241-1000101
1 OFF	FUNCTION CNTL KNOB FOR MSS1000 SERIES	204-1000101
2 OFF	MODULATOR SCREENING CAN-TOP REV I	315-0235001
1 OFF	MSS REMOVE PROTECTIVE FILM F/P LABEL	299-1001401
4 OFF	SELF-ADHESIVE FOOT (MOULDED BLACK)	208-0001400
6 OFF	SNAP RIVET-SR3555B BLACK PLASTIC RICHCO	247-3555111

SPARES - UNIQUE ELECTRICAL PARTS LIST

U22 Extension Board

U4	EPROM-27256 MSS1000 ENG V6 (805-1000105)	805-1000108

Main Board

PL1	FE CONNECTOR - 6 WAY TOP ENTRY JST	161-2000610
PL2	FE CONNECTOR-10 WAY TOP ENTRY FE-10-BT	161-2001010
PL3	FE CONNECTOR - 7 WAY TOP ENTRY JST	161-2000710
PL4	FE CONNECTOR - 9 WAY TOP ENTRY JST	161-2000910
PL7	FE CONNECTOR -11 WAY TOP ENTRY JST	161-2001110
PL12	FE CONNECTOR - 8 WAY TOP ENTRY JST	161-2000810
PL38	PIN HEADER-2WAY FRIC LOCK (JST B 2P-VH)	161-1000204
TUNER 1		
	PACE PG77G01 2GHZ D/LNB FIXED ‘F’ TUNER	221-2177012
J4	TINNED COPPOER WIRE LINK 0.61MM DIA	999-1099901

Retrofitted Components on Main Board

Fitted between pins 5 and 14 of U26 (ECO S000482 -see page 5)

330PF 100V 5MM CERAMIC CAP 20% TR	150-3317751

Fitted between C260 and a cut track (ECO S000498 - see page 5)

CABLE-55/0.1MM (0.43MM SQ) PVC YELLOW	190-5501210

Retrofitted Components on Sound Board

Fitted as described in ECO S000535 and PCO S000243 - see page 5

MOD WIRE 0.5MM X 20MM RED	190-0502015

NOTE: Please ignore the following Spares-Unique Mechanical Parts List if working on a MSS 1038 series receiver. The Spares-Unique Mechanical Parts List for the MSS 1038 series is included on page 72of this manual.

SPARES - UNIQUE MECHANICAL PARTS LIST

1 OFF	“ATTENTION INSTALLERS” MSS1000 ENG/GER	504-8661001
1 OFF	“DOLBY”,”PROLOGIC” TRADEMARK LABEL	299-1000219
1 OFF⚠	*A* UK MAINS LEAD 3A 3P/PLUG (BLACK)	191-1180280
1 OFF⚠	*A*MANUAL MSS1001-I V/CRYPT UK PACE ISS4	502-1010102
1 OFF⚠	*A*START-UP GUIDE - MSS1001-I MANUAL IS	504-2010102
1 OFF	BASE - MSS1000 UNIVERSAL (NO PWR RATING)	321-1000101
1 OFF	BLANKING PLUG MSS1000 IRTE+DISH POSITION	306-1001100
1 OFF	CABLE ASSY - COAX DOLBY POWER 425MM	266-1000022
1 OFF	CABLE-10WAY 230MM MSS1000 DISPLAY FFC	198-0230100
1 OFF	CABLE-11WAY 200MM MSS1000 CARD READ FFC	198-0200110
1 OFF	CABLE-6WAY 150MM MSS1000 DOLBY (1) FFC	198-0150060
1 OFF	CABLE-7WAY 180MM MSS1000 DOLBY FFC	198-0180070
1 OFF	CABLE-8WAY 154MM MSS1000 CARD READ FFC	198-0154080
1 OFF	CABLE-9WAY 150MM MSS1000 DOLBY FFC	198-0150090
1 OFF	CABLE-COAX UHF MALE TO FEMALE	198-0015021
1 OFF	CARDBOARD INTERNAL FITMENT MSS SERIES	444-1000102

1 OFF	CARTON - MSS1000 SERIES PACE - UK	412-1000100
1 OFF	COVER-MSS1000 SERIES-FRONT PANEL FINISH	312-1000001
1 OFF	FRONT PANEL MSS1001-I V/CRT 2CRD PACE V2	360-1112101
1 OFF	HANDLE/BACKING PLATE-MSS1000/500-CARTON	444-1500000
1 OFF	LABEL - ENHANCED LNB SOFTWARE	299-8661022
1 OFF	MSS1000 HANDSET BRANDED PACE	699-1000100
2 OFF	PILLAR - MSS1000 SUPPORT-PCB AMP/DISH	248-5080100
1 OFF	PILLAR-LCBS-14 (RICHCO)	248-0014002
12 OFF	PLASTITE SCREW-4 X 1/4 POZI PAN BLACK	245-4140011
1 OFF	PROG LIST SHEET-MSS1000 V/CRYPT UK PACE	504-1010101
8 OFF	SCREW-M3 X 8 P/P TAP.C/W WASHER BLK SEAL	246-3080011
1 OFF	UNBRANDED “HOME CINEMA GUIDE” MSS1000 UK	504-1000100
1 OFF	WASHER FOR ECW0J-C24 FUNCTION CONTROLL	241-0002420
2 OFF	HALF NUT 3/8 FORM 32 TOI.2A	240-1380011
1 OFF	NUT FOR ECW0J-C24 FUNCTION CONTROLLER	240-0002420

DIFFERENCES BETWEEN THE MSS 1001-I /500-I AND MSS 1038-G/538-G

DELETED COMPONENTS

The following components are excluded from the MSS 1038/538 series:

CARD READER BOARD

2 CARD READER BOARD and associated components

VIDEOCRYPT BOARD

VIDEOCRYPT BOARD and associated components

MAIN BOARD

C28
C29
C30
C31
C32
C33
C34
C35
C38
C39
C40
C42
C44
C199
C211
C212
C215
C500
C519
C587
C591
C604
.L5
L20
L21
L35
L36
L43
L44
L52
PLK7
PL12
Q14
Q15
Q16
Q17
Q29
Q98
Q114
Q115
R36
R62
R63
R64
R65
R66
R67
R68
R69
R70
R71
R72
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R103
R104
R105
R106
R156
R206
R207
R208
R354
R385
R404
R407
R411
R413
R414
R416
R417
R437
R440
R506
R519
R524
R526
R527
R528
R529
R530
R532
R533
R534
R535
R536
R537
R538
R539
R627
R629
R635
R645
R703
R704
R790
R791
TST1
U5
U6
U8
U9
U17
X1

ADDITIONAL COMPONENTS

The following additional components are present in the MSS 1038/538 series:

MAIN BOARD

U22	8663 PROC MSS100 ENG/GER	809-8663107
U29	TEA2130 SYNC SEP (DS173019) (THOMSON)	109-0213001
HAND MOD	HOT MELT ADHESIVE STICK	206-1059960
HAND MOD	TINNED COPPER WIRE LINKS 0.61MM DIA	999-1099902
LK6	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
PL5	PIN HEADER-2WAY FRIC LOCK (JST B 2P-VH)	161-1000204
R539	SMD 470R 0.1W 5% RES 0805 (TRS)	940-4710501

CHANGED COMPONENTS

The following components differ from those in the MSS 1001-I/501-I as listed below:

MAIN BOARD

C256	SMD 470PF 50V 10% CER X7R CAP 0805	950-4715621
TUNER 1	PACE PG77G04 2GHZ D/LNB (18/27)'F'TUNER	221-2177042
L31	TINNED COPPER WIRE LINKS 0.61MM DIA	999-1099902
PL11	FE CONNECTOR 12-WAY TOP ENTRY	161-2001210
R65	SMD 2K2 0.1W 5% RES 0805 (TRS)	940-2220501
R207	SMD 3K3 0.1W 5% RES 0805 (TRS)	940-3320501
R210	75R 0.25W 5% CARBON FILM RES	140-7502501
R354	SMD 5K6 0.1W 5% RES 0805 (TRS)	940-5620501
R634	SMD 100R 0.1W 5% RES 0805 (TRS)	940-1010501
R708	SMD 100R 0.1W 5% RES 0805 (TRS)	940-1010501

SPARES - UNIQUE MECHANICAL PARTS LIST FOR MSS 1038-G

1 OFF	"ATTENTION INSTALLERS" MSS1000 ENG/GER	504-8661001
1 OFF	"DOLBY","PROLOGIC" TRADEMARK LABEL	299-1000219
1 OFF⚠	*A* UK MAINS CABLE-EURO"8" + 2 PIN PLUG	191-2015280
1 OFF⚠	*A*MANUAL MSS1034-G NON-IRD S/S PACE	502-1201100
1 OFF⚠	*A*START-UP GUIDE - MSS1034-G NON-IRD PACE	504-0140100
1 OFF	BASE - MSS1000 UNIVERSAL (NO PWR RATING)	321-1000101
1 OFF	BLANKING PLUG MSS1000 IRTE+DISH POSITION	306-1001100
1 OFF	CABLE ASSY - UHF M TO F 1.5M BLACK "FITZ"	198-0015121
1 OFF	CABLE-10WAY 230MM MSS1000 DISPLAY FFC	198-0230100
1 OFF	CABLE-6WAY 150MM MSS1000 DOLBY (1) FFC	198-0150060
1 OFF	CABLE -7WAY 120MM DOLBY FFC	198-0120070
1 OFF	CABLE-9WAY 150MM MSS1000 DOLBY FFC	198-0150090
1 OFF	CABLE-ASSY - COAX DOLBY POWER 425MM	266-1000022
1 OFF	CARDBOARD INTERNAL FITMENT MSS SERIES	444-1000101
1 OFF	CARTON - MSS1000 SERIES PACE - WORLD	412-1001100
1 OFF	COVER-MSS1000/500 SERIES (PAINTED)	312-1000002
1 OFF	FRONT PANEL MSS1034-G NON-IRD S/S PACE	360-1000101
1 OFF	HANDLE-MSS1000/500-CARTON	444-1500010
1 OFF	BACKING PLATE-MSS1000/500-CARTON	444-1500020
1 OFF	MSS1000 HANDSET BRANDED PACE	699-1000100
2 OFF	PILLAR - MSS1000 SUPPORT-PCB AMP/DISH	248-5080100
2 OFF	PILLAR-SP1-4-01 STAND-OFF (RICHCO)	248-1401001
1 OFF	SUPP POST DUAL LOCKING DLSP-1-6M-01RICHO	248-0160100
12 OFF	PLASTITE SCREW-4 X 1/4 POZI PAN BLACK	245-4140011
1 OFF	PROG LIST SHEET-MSS1034-G NON-IRD PACE	504-1001100
8 OFF	SCREW-M3 X 8 P/P TAP.C/W WASHER BLK SEAL	246-3080011
1 OFF	WASHER FOR ECW0J-C24 FUNCTION CONTROLL	241-0002420
2 OFF	HALF NUT 3/8 FORM 32 TOI.2A	240-1380011
1 OFF	NUT FOR ECW0J-C24 FUNCTION CONTROLLER	240-0002420

DISH POSITIONER PCB – SPARE PARTS LIST

Capacitors

C1	SMD 1NF 50V 5% CER COG CAP 0805 (TRS)	950-1025501
C2	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C3	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C4	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C5	SMD 1NF 50V 5% CER COG CAP 0805 (TRS)	950-1025501
C6	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C7	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C8	SMD 1NF 50V 5% CER COG CAP 0805 (TRS)	950-1025501
C9	SMD 1NF 50V 5% CER COG CAP 0805 (TRS)	950-1025501
C10	SMD 1NF 50V 5% CER COG CAP 0805 (TRS)	950-1025501
C11	SMD 1NF 50V 5% CER COG CAP 0805 (TRS)	950-1025501
C13	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C14	SMD 10NF 50V 10% CER X7R CAP 0805 (TRS)	950-1035621
C15	SMD 33PF 50V 5% CER COG CAP 0805 (TRS)	950-3305501
C16	SMD 33PF 50V 5% CER COG CAP 0805 (TRS)	950-3305501
C17	SMD 100PF 50V 5% CER COG CAP 0805 (TRS)	950-1015501
C18	SMD 100PF 50V 5% CER COG CAP 0805 (TRS)	950-1015501
C19	SMD 100PF 50V 5% CER COG CAP 0805 (TRS)	950-1015501
C20	10UF 50V 20% 105DEG RADIAL ELECT' CAP TR	855-1065751
C21	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C22	SMD 33PF 50V 5% CER COG CAP 0805 (TRS)	950-3305501
C23	SMD 33PF 50V 5% CER COG CAP 0805 (TRS)	950-3305501
C24	SMD 100PF 50V 5% CER COG CAP 0805 (TRS)	950-1015501
C25	SMD 100PF 50V 5% CER COG CAP 0805 (TRS)	950-1015501
C26	SMD 100PF 50V 5% CER COG CAP 0805 (TRS)	950-1015501
C27	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C28	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C29	SMD 100PF 50V 5% CER COG CAP 0805 (TRS)	950-1015501
C31	10UF 50V 20% 105DEG RADIAL ELECT' CAP TR	855-1065751
C32	100UF 25V 20% 105DEG RADIAL ELECT CAP TR	855-1072751
C33	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C34	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C35	1000UF 16V RADIAL ELECT' CAP TR	855-1081951
C36	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C37	SMD 100PF 50V 5% CER COG CAP 0805 (TRS)	950-1015501
C38	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C39	100UF 35V RADIAL ELECT' CAP TR	855-1073951
C40	10UF 50V 20% 105DEG RADIAL ELECT' CAP TR	855-1065751
C41	SMD 47NF 50V 10% CER X7R CAP 0805 (TRS)	950-4735621
C42	SMD 47NF 50V 10% CER X7R CAP 0805 (TRS)	950-4735621
C43	SMD 47NF 50V 10% CER X7R CAP 0805 (TRS)	950-4735621
C44	SMD 47NF 50V 10% CER X7R CAP 0805 (TRS)	950-4735621
C45	SMD 100PF 50V 5% CER COG CAP 0805 (TRS)	950-1015501
C46	SMD 100PF 50V 5% CER COG CAP 0805 (TRS)	950-1015501
C47	10UF 50V 20% 105DEG RADIAL ELECT' CAP TR	855-1065751
C48	470UF 50V 105 DEG RADIAL ELECT CAP	855-4775950
C49	1U5 100V 22.5MM BOX POLYESTER CAP	152-1527690
C50	SMD 47NF 50V 10% CER X7R CAP 0805 (TRS)	950-4735621
C51	SMD 47NF 50V 10% CER X7R CAP 0805 (TRS)	950-4735621
C52	10UF 50V 20% 105DEG RADIAL ELECT' CAP TR	855-1065751
C53	SMD 1NF 50V 5% CER COG CAP 0805 (TRS)	950-1025501
C54	10UF 50V 20% 105DEG RADIAL ELECT' CAP TR	855-1065751
C55	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C56	SMD 47NF 50V 10% CER X7R CAP 0805 (TRS)	950-4735621

Diodes

D1	SMD DUAL DIODE-BAT17-06 C/ANODE SOT23 TR	912-0601751
D2	SMD DIODE-BAS16/DAN212KT146 SOT-23	912-0001651
D3	SMD DIODE-BAS16/DAN212KT146 SOT-23	912-0001651
D4	DIODE-1N4007 TR	120-0400701
D5	DIODE-1N4007 TR	120-0400701
D6	SMD DIODE-BAS16/DAN212KT146 SOT-23	912-0001651
D7	SMD DIODE-BAS16/DAN212KT146 SOT-23	912-0001651
D8	DIODE-1N4007 TR	120-0400701
D9	DIODE-1N4007 TR	120-0400701
D10	5V6 5% 400MW ZENER DIODE TR	125-0056501
D11	DIODE-1N4007 TR	120-0400701
D12	DIODE - EGP30B TR	120-1003001
D13	SMD DIODE-BAS16/DAN212KT146 SOT-23	912-0001651
D14	5V6 5% 400MW ZENER DIODE TR	125-0056501
D15	SMD DIODE-BAS16/DAN212KT146 SOT-23	912-0001651
D16	SMD DIODE-BAS16/DAN212KT146 SOT-23	912-0001651
D17	DIODE-1N4007 TR	120-0400701
D18	DIODE-1N4007 TR	120-0400701
D19	DIODE-1N4007 TR	120-0400701
D20	DIODE-1N4007 TR	120-0400701

Transistors

Q1	SMD TRANSISTOR-FMMT2369A SOT-23	911-0236951
Q2	SMD TRANSISTOR-FMMT2369A SOT-23	911-0236951
Q3	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q4	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q5	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q6	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q7	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q8	SMD TRANSISTOR-BC856B SOT-23	911-1085651
Q9	SMD TRANSISTOR-BC846B SOT-23	911-1084651

Resistors

R1	SMD 330R 0.1W 5% RES 0805 (TRS)	940-3310501
R2	SMD 3K3 0.1W 5% RES 0805 (TRS)	940-3320501
R3	SMD 1K8 0.1W 5% RES 0805 (TRS)	940-1820501
R4	SMD 330R 0.1W 5% RES 0805 (TRS)	940-3310501
R5	SMD 1K5 0.1W 5% RES 0805 (TRS)	940-1520501
R6	SMD 680R 0.1W 5% RES 0805 (TRS)	940-6810501
R7	SMD 330R 0.1W 5% RES 0805 (TRS)	940-3310501
R8	SMD 3K3 0.1W 5% RES 0805 (TRS)	940-3320501
R9	SMD 1K8 0.1W 5% RES 0805 (TRS)	940-1820501
R10	SMD 330R 0.1W 5% RES 0805 (TRS)	940-3310501
R11	SMD 1K5 0.1W 5% RES 0805 (TRS)	940-1520501
R12	SMD 680R 0.1W 5% RES 0805 (TRS)	940-6810501
R13	SMD 1K 0.1W 5% RES 0805 (TRS)	940-1020501
R14	SMD 100K 0.1W 5% RES 0805 (TRS)	940-1040501
R15	SMD 100K 0.1W 5% RES 0805 (TRS)	940-1040501
R16	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R17	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R18	SMD 470K 0.1W 5% RES 0805 (TRS)	940-4740501
R19	SMD 100K 0.1W 5% RES 0805 (TRS)	940-1040501
R20	SMD 1M 0.1W 5% RES 0805 (TRS)	940-1050501
R21	SMD 200K 0.1W 5% RES 0805 (TRS)	940-2040501
R22	SMD 4K7 0.1W 5% RES 0805 (TRS)	940-4720501
R23	SMD 4K7 0.1W 5% RES 0805 (TRS)	940-4720501
R24	SMD 4K7 0.1W 5% RES 0805 (TRS)	940-4720501
R25	SMD 20K 0.1W 5% RES 0805 (TRS)	940-2030501
R26	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R27	SMD 20K 0.1W 5% RES 0805 (TRS)	940-2030501
R28	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R29	SMD 20K 0.1W 5% RES 0805 (TRS)	940-2030501
R30	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R31	SMD 20K 0.1W 5% RES 0805 (TRS)	940-2030501
R32	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R33	SMD 20K 0.1W 5% RES 0805 (TRS)	940-2030501
R34	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R35	SMD 20K 0.1W 5% RES 0805 (TRS)	940-2030501
R36	SMD 20K 0.1W 5% RES 0805 (TRS)	940-2030501
R37	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R38	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R39	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R40	SMD 1K 0.1W 5% RES 0805 (TRS)	940-1020501
R41	SMD 20K 0.1W 5% RES 0805 (TRS)	940-2030501
R42	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501

R43	SMD 20K 0.1W 5% RES 0805 (TRS)	940-2030501
R44	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R45	SMD 20K 0.1W 5% RES 0805 (TRS)	940-2030501
R46	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R47	SMD 20K 0.1W 5% RES 0805 (TRS)	940-2030501
R48	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R49	SMD 20K 0.1W 5% RES 0805 (TRS)	940-2030501
R50	SMD 20K 0.1W 5% RES 0805 (TRS)	940-2030501
R51	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R52	SMD 1K 0.1W 5% RES 0805 (TRS)	940-1020501
R53	SMD 10M 0.1W 5% RES 0805 (TR)	940-1060501
R54	SMD 910K 0.1W 5% RES 0805 (TRS)	940-9140501
R55	SMD 3R9 0.1W 5% RES 0805 (TRS)	940-0390501
R56	SMD 4K7 0.1W 5% RES 0805 (TRS)	940-4720501
R57	SMD 1K 0.1W 5% RES 0805 (TRS)	940-1020501
R58	SMD 100R 0.1W 5% RES 0805 (TRS)	940-1010501
R59	SMD 2K2 0.1W 5% RES 0805 (TRS)	940-2220501
R60	SMD 4K7 0.1W 5% RES 0805 (TRS)	940-4720501
R61	SMD 100R 0.1W 5% RES 0805 (TRS)	940-1010501
R62	SMD 4K7 0.1W 5% RES 0805 (TRS)	940-4720501
R63	SMD 4K7 0.1W 5% RES 0805 (TRS)	940-4720501
R64	SMD 20K 0.1W 5% RES 0805 (TRS)	940-2030501
R65	0R4 5W 5% AX/PLUG CER CASE RES	145-0049500
R66	SMD 6K8 0.1W 5% RES 0805 (TRS)	940-6820501
R67	2R2 1W 5% CARBON FILM RES TR	140-0226501
R68	SMD 20K 0.1W 5% RES 0805 (TRS)	940-2030501
R69	SMD 100R 0.1W 5% RES 0805 (TRS)	940-1010501
R70	SMD 4K7 0.1W 5% RES 0805 (TRS)	940-4720501
R71	SMD 20K 0.1W 5% RES 0805 (TRS)	940-2030501
R72	SMD 100R 0.1W 5% RES 0805 (TRS)	940-1010501
R73	SMD 4K7 0.1W 5% RES 0805 (TRS)	940-4720501
R74	SMD 1K 0.1W 5% RES 0805 (TRS)	940-1020501
R75	SMD 1M 0.1W 5% RES 0805 (TRS)	940-1050501
R76	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R77	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R78	SMD 100K 0.1W 5% RES 0805 (TRS)	940-1040501
R79	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R80	SMD 4K7 0.1W 5% RES 0805 (TRS)	940-4720501

ICs

U1	TLC272CP DUAL CMOS OP AMP LOW BIAS (TI)	100-0027201
U2	SDA 2586 8K EE (SIEMENS)	104-0240801
U3	LM393 DUAL COMPARATOR	100-0039300
U4	Z86E3012PSC-4K OTP 28 PIN MSS DISH	808-8630120
U5	REVERSIBLE DC MOTOR DRIVER BA6109	107-0610900
U6	V/REGULATOR-78L12 +12V 100MA TO-92	105-1781200
U7	V/REGULATOR-LM340T5 +5V 1.5A TO-220	105-0034000
U8	V/REGULATOR-LM78M05 +5V 0.5A -T0220	105-0780500
U9	V/REGULATOR-LM338T TO220 5A VARIABLE	105-0338000
U10	LM358/KA358 DUAL OP AMP LOW POWER	100-0035800

Miscellaneous

HS1	HEATSINK-TV216 POWERFIN (TO220)	202-0021600
HS1	KEROTHERM PAD TYPE 86/37 (13.5X37X0.2)	208-0863701
HS1	SPRING CLAMP-7701 TO220 FOR TV216 H/SINK	249-0770100
L1	AXIAL INDUCTOR-18UH 10% DC RES <0.8R TR	130-0180611
PL1	FE CONNECTOR - 12 WAY SIDE ENTRY JST	161-2101210
PL2	PIN HEADER-2WAY FRIC LOCK (JST B 2P-VH)	161-1000204
RL1	RELAY-VSB12-STB 12V TAKAMISAWA	136-0001201
RL2	RELAY-VSB12-STB 12V TAKAMISAWA	136-0001201
SK1	8 POLE PUSH TERMINAL HSP128V-03	163-5000800
X1	FILTER-SFE 10.7MJA 10K-A (MURATA)	173-0107003
X2	XTAL 12MHZ HC49 50 50 10 30	170-0120010
1	CABLE-12WAY 125MM DISH POS FFC	198-0125120
1	SNAP RIVET- SR3555B BLACK PLASTIC RICHCO	247-3555111
1	CABLE ASSY-2WAY DISH POS-IRTE POWER	266-1000021
1	SHIELDING PLATE DISH POS/IRTE	307-0236100
1	COVER - VAC FORMED FOR DISH POS PCB	312-1000281

Differences to main PCB components to accomodate Dish Positioner PCB

MSS 1000 Series

Components added

TINNED COPPER WIRE LINKS 0.61MM DIA - PMF		999-1099902
DP1-2	WIRE-0.5 X 50MM 9 (INS LENGTH) RED	190-0505015
DP3-4	WIRE-0.5 X 50MM 9 (INS LENGTH) RED	190-0505015
U22	SOCKET 20 WAY TOP ENTRY (HARWIN)	161-2002001
Z8-BOARD - EPROM 27256 MSS1034-GP ENG DISH POS		805-1000106
PL11	FE CONNECTOR - 12 WAY TOP ENTRY JST	161-2001210
PILLAR-LCBS-14(RICHO) Z8 BOARD		248-0014002
DISH SUPPORT MSS1000 SUPPORT PCB AMP/DISH		248-5080100

Components deleted

X3	XTAL 16MHZ HC49U 50/50/-10+60 30PF PAR	170-0160000
U22	8663 PROC MSS1000 ENG/GER	809-8663107

Components changed

Tuner 1 - PACE PG77G04 2GHZ D/LNB (18/27) F 221-2177042

becomes

Tuner 1 - PACE PG77G04 2.15GHZ D/LNB (18/27) F 221-2178042

MSS 500 Series

Components added

DP1-2	WIRE-0.5 X 50MM 9 (INS LENGTH) RED	190-0505015
DP3-4	WIRE-0.5 X 50MM 9 (INS LENGTH) RED	190-0505015
U22	SOCKET 20 WAY TOP ENTRY (HARWIN)	161-2002001
Z8-BOARD - EPROM 27256 MSS1034-GP ENG DISH POS		805-1000106
PL11	FE CONNECTOR - 12 WAY TOP ENTRY JST	161-2001210
PILLAR-LCBS-14(RICHO) Z8 BOARD		248-0014002
PSU1-PSU2	CABLE-55/0.1MM (0.43MM SQ) PVC YELLOW	190-5501210
C7	CER CAP 1NF 2KV 7.5MM 10% HR SERIES TR	159-1029651
C216	1000UF 63V 7.5MM 20% 105C R/E CAP 16X32	855-1086770
C295	CLASS X CAP-100NF 250V 20%	159-1048780
D54	RECT DIODE 300V (FES8FT)	120-0008001
D72	DIODE-BYV96D (PHILIPS) TR	120-0009611
DISH SUPPORT MSS1000 SUPPORT PCB AMP/DISH		248-5080100
MOUNTING BRACKET - DUMMY LOAD RESISTOR		305-0500100
SCREW M3 X 8 P/P TAP.C/W WASHER BLK SEAL		246-3080011
CABLE ASSY - DUMMY LOAD RESISTOR INC/RES		199-0500100
PL5	PIN HEADER-2WAYFRIC LOCK (JST B VH)	161-1000204
PL38	PIN HEADER-2WAYFRIC LOCK (JST B VH)	161-1000204
R110	220K 2W 5% CARBON FILM RES TR	142-2247501

Components deleted

X3	XTAL 16MHZ HC49U 50/50/-10+60 30PF PAR	170-0160000
U22	8663 PROC MSS1000 ENG/GER	809-8663107

Components changed

Tuner 1 - PACE PG77G04 2GHZ D/LNB (18/27) F 221-2177042

becomes

Tuner 1 - PACE PG77G04 2.15GHZ D/LNB (18/27) F 221-2178042

R1 10R 2W ±25% METOX NON-SPIRAL RES 143-1007821

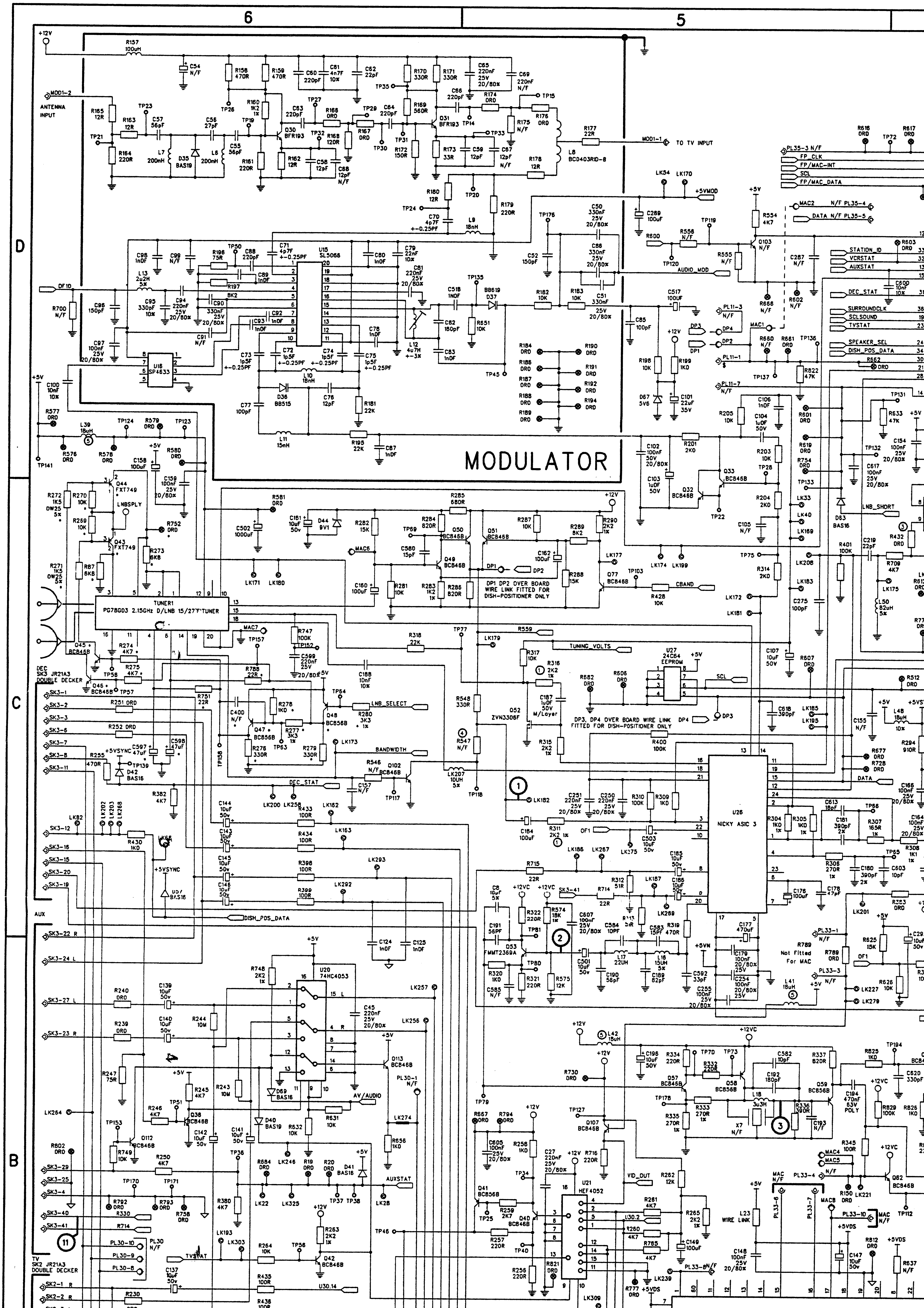
becomes

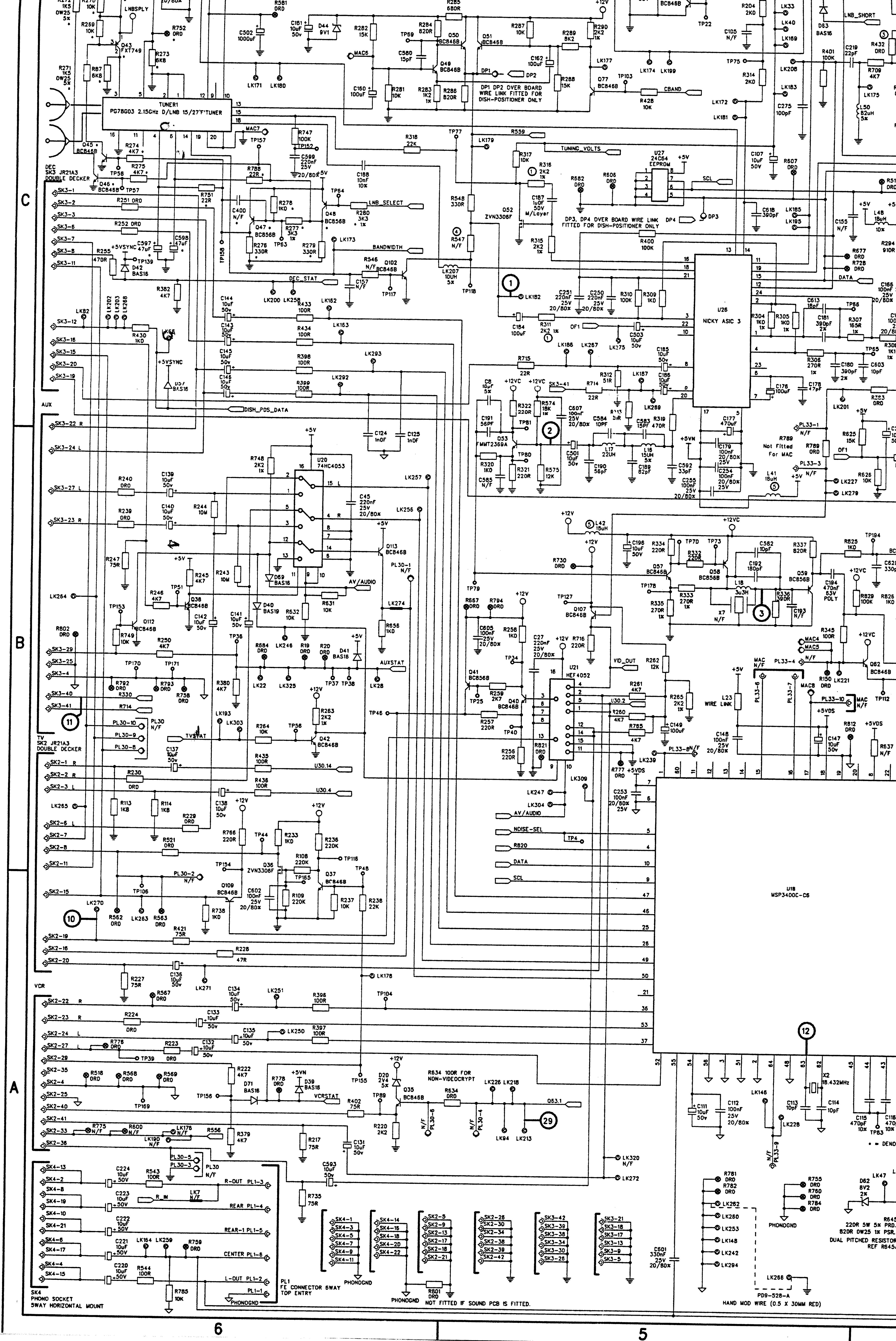
R1 6R8 7W 5% WW/CER HOR/PLUGABLE RES 144-0689510

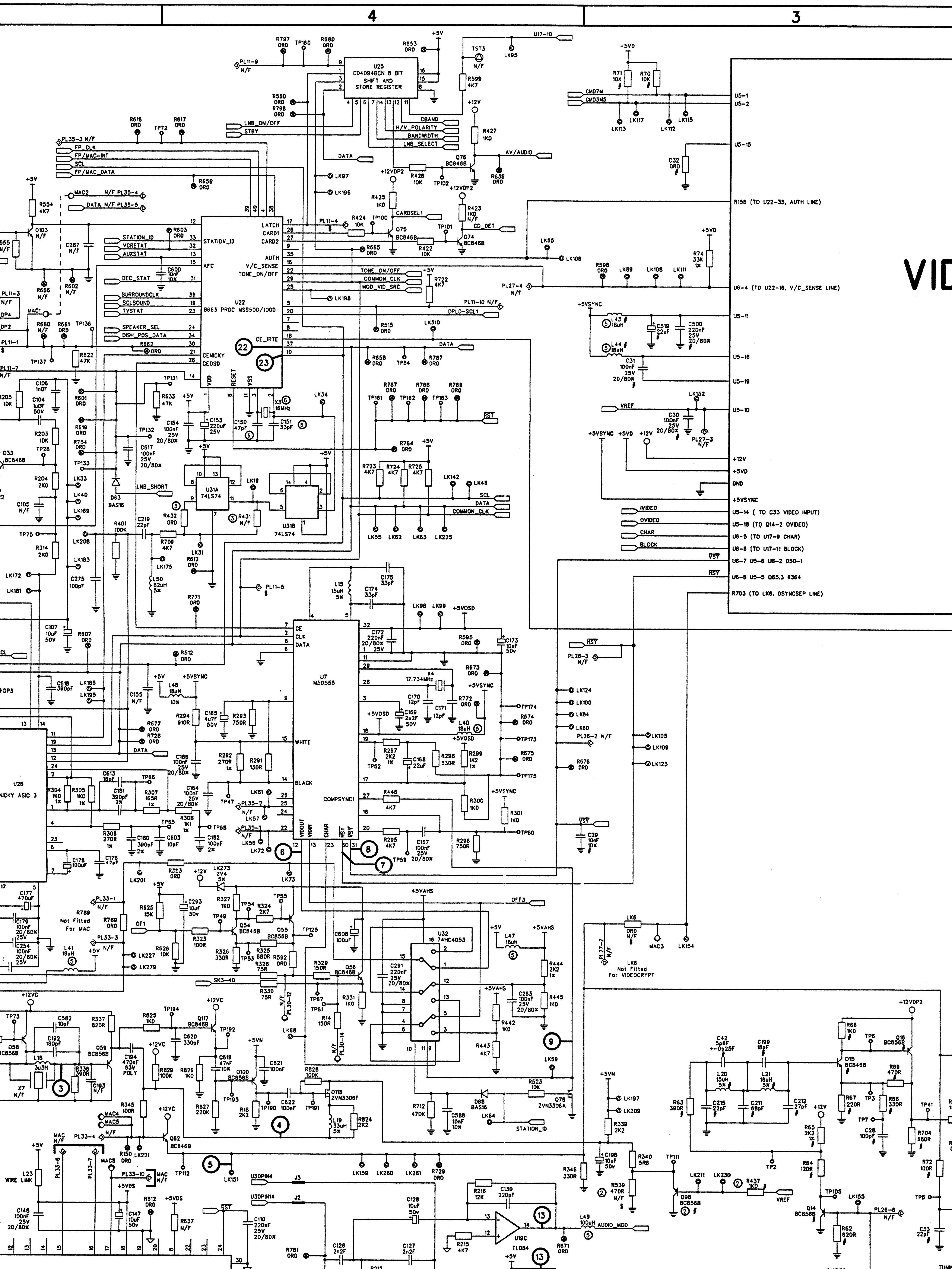
NOTES

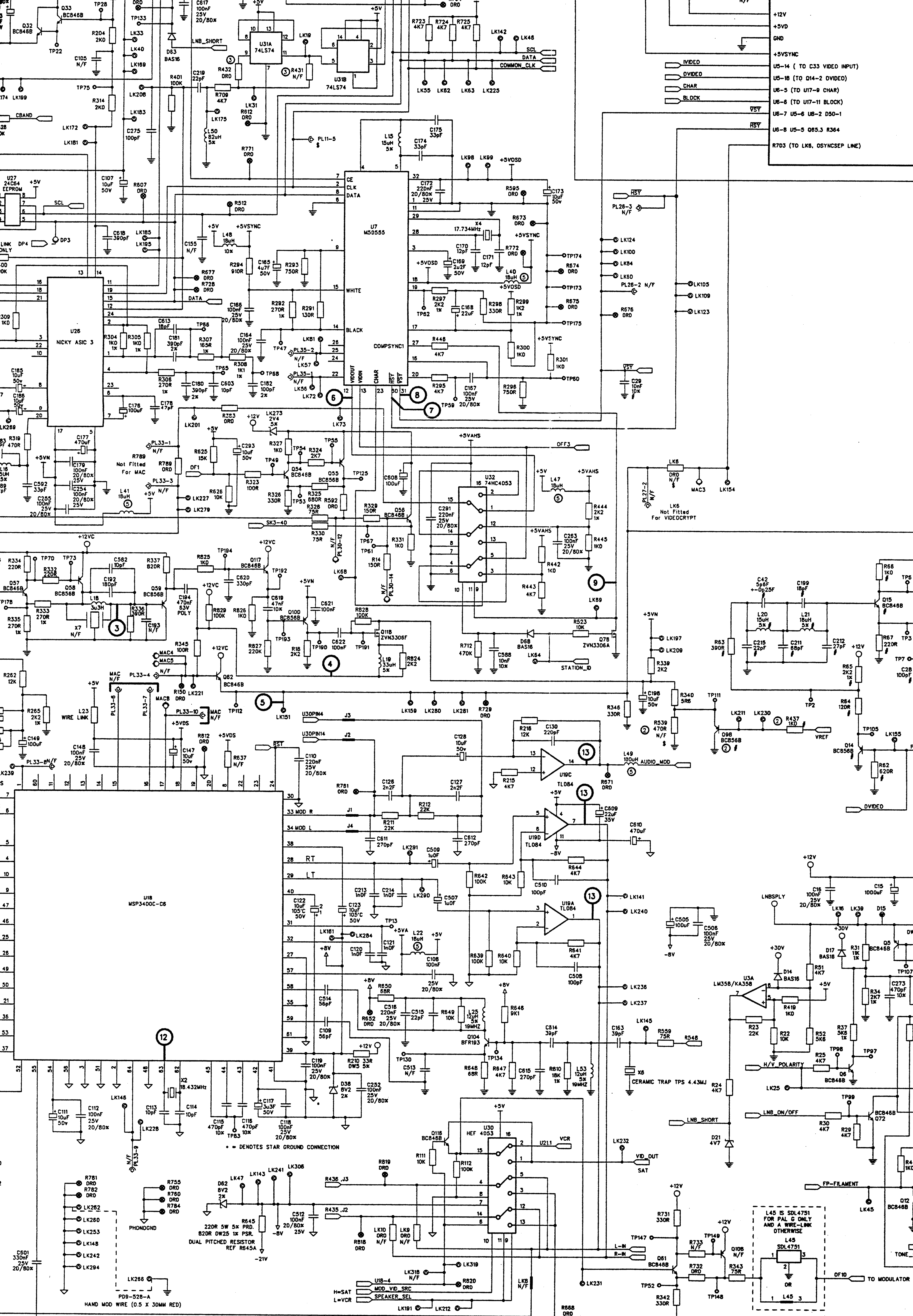
NOTES

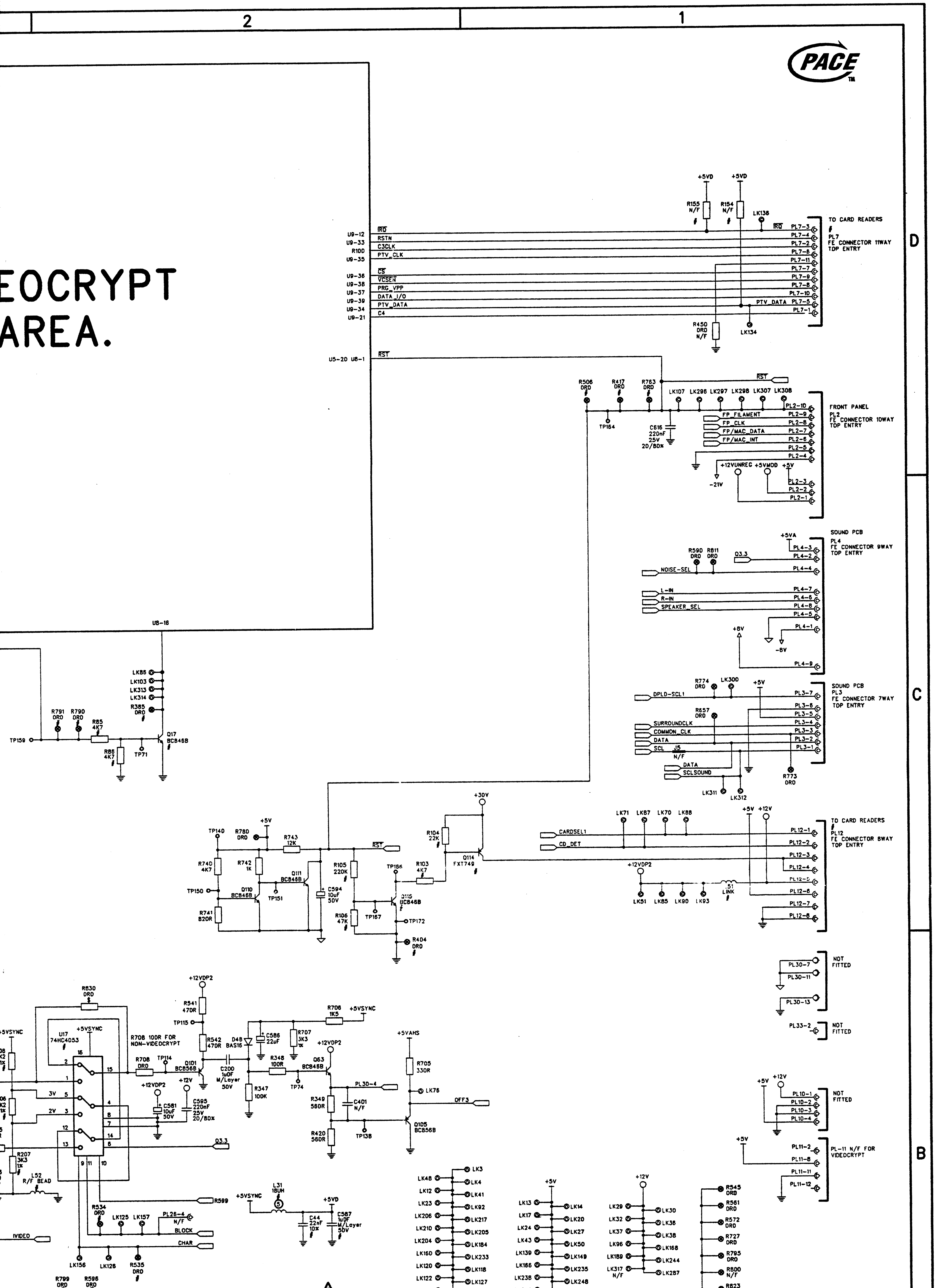
CIRCUIT DIAGRAM OF MAIN BOARD

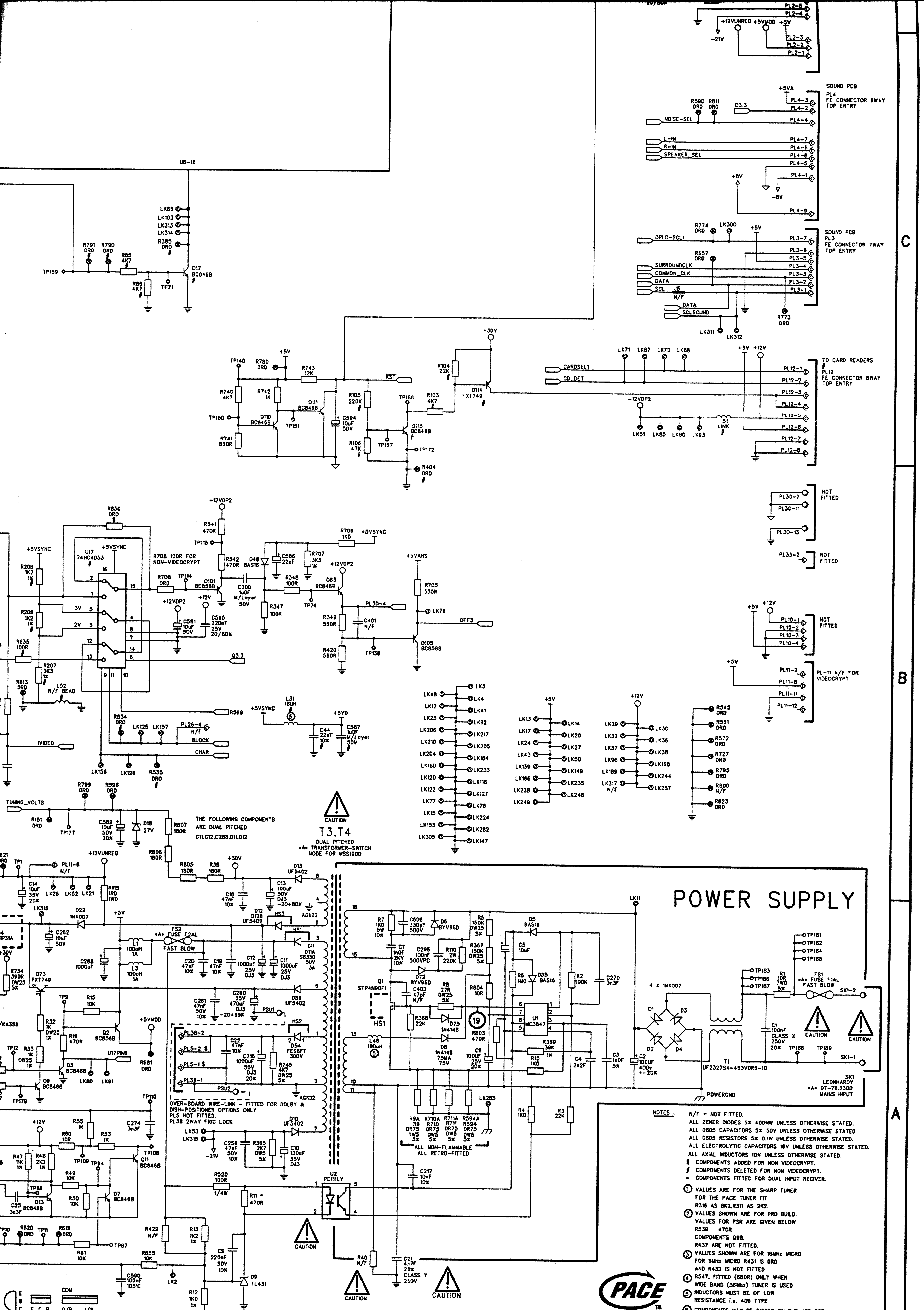

6
5
D
C
B
MODULATOR
+12V
ANTENNA INPUT
MOD1-2
MOD1-1
TO TV INPUT
U15 SL5068
U16 SP4633
Q30 BFR193
Q31 BFR193
D35 BAS19
L8 BC0403RID-8
BB619 D37
D36 BB515
OF10
+5VMOD
FP_CLK
FP/MAC-INT
SCL
FP/MAC_DATA
PL35-3 N/F
MAC2 N/F PL35-4
DATA N/F PL35-5
AUDIO_MOD
Q103 N/F
STATION_ID
VCRSTAT
AUXSTAT
DEC_STAT
SURROUNDCLK
SCLSOUND
TVSTAT
SPEAKER_SEL
DISH_POS_DATA
PL11-3 N/F
PL11-1
PL11-7 N/F
MAC1
DP1 DP2 DP3 DP4
Q32 BC846B
Q33 BC846B
D63 BAS16
LNB_SHORT
TUNER1 PG78G03 2.15GHz D/LNB 15/27"F"TUNER
Q44 FXT749
Q43 FXT749
LNBSPLY
Q45 BC846B
Q46 BC846B
DEC SK3 JR21A3 DOUBLE DECKER
SK3-1
SK3-2
SK3-3
SK3-6
SK3-7
SK3-8
SK3-11
SK3-12
SK3-16
SK3-15
SK3-20
SK3-19
AUX
SK3-22 R
SK3-24 L
SK3-27 L
SK3-23 R
SK3-29
SK3-25
SK3-4
SK3-40
SK3-41
D44 9V1
Q50 BC846B
Q51 BC846B
Q49 BC846B
Q77 BC846B
MAC6
DP1 DP2 OVER BOARD WIRE LINK FITTED FOR DISH-POSITIONER ONLY
CBAND
MAC7
Q47 BC856B
Q48 BC856B
LNB_SELECT
BANDWIDTH
Q102 BC846B
DEC_STAT
TUNING_VOLTS
U27 24C64 EEPROM
Q52 ZVN3306F
DP3, DP4 OVER BOARD WIRE LINK FITTED FOR DISH-POSITIONER ONLY
U26 NICKY ASIC 3
DATA
OF1
Q53 FMMT2369A
SK3-41
PL33-1 N/F
R789 Not Fitted For MAC
PL33-3 N/F
+5VN
D42 BAS16
+5VSYNC
D57 BAS16
DISH_POS_DATA
U20 74HC4053
Q113 BC846B
AV/AUDIO
PL30-1 N/F
D69 BAS16
D40 BAS19
D41 BAS16
AUXSTAT
Q38 BC846B
Q112 BC846B
Q42 BC846B
TVSTAT
PL30 N/F
PL30-10
PL30-9
PL30-8
TV SK2 JR21A3 DOUBLE DECKER
SK2-1 R
SK2-2 R
U30.14
Q57 BC846B
Q58 BC856B
Q59 BC856B
X7 N/F
Q107 BC846B
Q41 BC856B
D40 BC846B
U21 HEF4052
VID_OUT
U30.2
MAC4
MAC5
PL33-4
PL33-6
PL33-7
MAC N/F
MAC8
PL33-10
Q62 BC846B
WIRE LINK
PL33-8 N/F
+5VDS
+12VC
+5VS


TUNER1
PG78G03 2.15GHz D/LNB 15/27 TUNER
LNBSPLY
Q43 FXT749
DEC SK3 JR21A3 DOUBLE DECKER
DP1 DP2 OVER BOARD WIRE LINK FITTED FOR DISH-POSITIONER ONLY
TUNING_VOLTS
U27 24C64 EEPROM
DP3, DP4 OVER BOARD WIRE LINK FITTED FOR DISH-POSITIONER ONLY
LNB_SELECT
BANDWIDTH
DEC_STAT
CBAND
LNB_SHORT
SCL
DATA
U26 NICKY ASIC 3
DISH_POS_DATA
AUX
U20 74HC4053
AV/AUDIO
AUXSTAT
TV SK2 JR21A3 DOUBLE DECKER
TVSTAT
U21 HEF4052
VID_OUT
NOISE-SEL
R820
U18 MSP3400C-C6
X2 18.432MHz
VCR
VCRSTAT
R634 100R FOR NON-VIDEOCRYPT
Q53.1
SK4 PHONO SOCKET 5WAY HORIZONTAL MOUNT
PL1 FE CONNECTOR 5WAY TOP ENTRY
R-OUT PL1-3
REAR PL1-4
REAR-1 PL1-5
CENTER PL1-6
L-OUT PL1-2
PHONOGND
R801 ORD NOT FITTED IF SOUND PCB IS FITTED.
PD9-528-A
HAND MOD WIRE (0.5 X 30MM RED)
220R 5W 5% PRD. 820R 0W25 1% PSR. DUAL PITCHED RESISTOR REF R645
WIRE LINK
C
B
A
6
5
①
②
③
④
⑤
⑩
⑪
⑫
㉙


4
3
U25 CD4094BCN 8 BIT SHIFT AND STORE REGISTER
U22 8663 PROC MSS500/1000
STATION_ID
AFC
LATCH
CARD1
CARD2
AUTH
V/C_SENSE
TONE_ON/OFF
CE_IRTE
CENICKY
CEOSD
VDD
RESET
VSS
X3 16MHz
U31A 74LS74
U31B 74LS74
U7 M50555
CE
CLK
DATA
WHITE
BLACK
COMPSYNC1
VIDOUT
VIDIN
CHAR
HSY
VSY
X4 17.734MHz
U26 NICKY ASIC 3
U32 74HC4053
U19C TL084
LNB_ON/OFF
STBY
FP_CLK
FP/MAC-INT
SCL
FP/MAC_DATA
CBAND
H/V_POLARITY
BANDWIDTH
LNB_SELECT
AV/AUDIO
CARDSEL1
CD_DET
DEC_STAT
SURROUNDCLK
SCLSOUND
TVSTAT
SPEAKER_SEL
DISH_POS_DATA
VCRSTAT
AUXSTAT
COMMON_CLK
MOD_VID_SRC
DPLD-SCL1
LNB_SHORT
RST
OFF3
SK3-40
AUDIO_MOD
VREF
VID
U5-1
U5-2
U5-15
R156 (TO U22-35, AUTH LINE)
U6-4 (TO U22-16, V/C_SENSE LINE)
U5-11
U5-16
U5-19
U5-10
+12V
+5VD
GND
+5VSYNC
U5-14 (TO C33 VIDEO INPUT)
U5-18 (TO Q14-2 OVIDEO)
U6-5 (TO U17-9 CHAR)
U6-6 (TO U17-11 BLOCK)
U6-7 U5-6 U8-2 D50-1
U6-8 U5-5 Q65.3 R364
R703 (TO LK6, OSYNCSEP LINE)
IVIDEO
OVIDEO
CHAR
BLOCK
CMD7M
CMD3M5
LK6 Not Fitted For VIDEOCRYPT
R789 Not Fitted For MAC
L23 WIRE LINK
MAC4
MAC5
MAC6
MAC3
U30PIN4
U30PIN14
J3
J2
+5VAHS
+5VOSD
+5VN
+5VDS
+12VC
+12VDP2


Q33 BC846B
Q32 BC846B
TP28
TP22
R204 2K0
TP133
LK33
LK40
LK169
C105 N/F
TP75
R314 2K0
LK208
LK183
LK172
LK181
LK199
CBAND
C617 100nF 25V 20/80%
D63 BAS16
LNB_SHORT
R401 100K
C219 22pF
R709 4K7
R432 0R0
U31A 74LS74
LK19
R431 N/F
U31B 74LS74
LK31
R612 0R0
LK175
L50 82uH 5%
C275 100pF
R771 0R0
PL11-5
C107 10uF 50V
R607 0R0
R723 4K7
R724 4K7
R725 4K7
LK142
LK48
SCL
DATA
COMMON_CLK
LK55
LK62
LK63
LK225
+12V
+5VD
GND
+5VSYNC
IVIDEO
DVIDEO
CHAR
BLOCK
VSY
HSY
U5-14 (TO C33 VIDEO INPUT)
U5-18 (TO D14-2 DVIDEO)
U6-5 (TO U17-9 CHAR)
U6-6 (TO U17-11 BLOCK)
U6-7 U5-6 U8-2 D50-1
U6-8 U5-5 Q65.3 R364
R703 (TO LK6, OSYNCSEP LINE)
L15 15uH 5%
C175 33pF
C174 33pF
LK98
LK99
+5VOSD
U27 24C64 EEPROM
R512 0R0
DP3
DP4
LINK ONLY
C618 390pF
LK185
LK195
C155 N/F
L48 18uH 10%
+5VSYNC
R294 910R
C165 4u7F 50V
R293 750R
U7 M50555
CE
CLK
DATA
WHITE
BLACK
COMPSYNC1
VIDOUT
VIDIN
CHAR
HSY
VSY
C172 220nF 20/80% 25V
R595 0R0
C173 10uF 50V
X4 17.734MHz
R673 0R0
C170 12pF
C171 12pF
R772 0R0
+5VSYNC
+5VOSD
C169 2u2F 50V
L40 18uH
TP174
R674 0R0
TP173
R297 2K2 1%
TP62
C168 22uF
R298 330R
R299 1K2 1%
R675 0R0
TP175
R448 4K7
R300 1K0
+5VSYNC
R301 1K0
R295 4K7
C167 100nF 25V 20/80%
R296 750R
TP60
TP59
PL26-3 N/F
LK124
LK100
LK84
LK60
PL26-2 N/F
R676 0R0
LK105
LK109
LK123
C29 10nF 10%
U26 NICKY ASIC 3
R677 0R0
R728 0R0
R309 1K0
R304 1K0 1%
R305 1K0 1%
C613 18pF
C181 390pF 2%
TP86
R307 165R
C166 100nF 25V 20/80%
C164 100nF 25V 20/80%
R292 270R 1%
R291 130R
LK61
TP47
PL35-2 N/F
LK57
PL35-1 N/F
LK56
LK72
R308 1K1 1%
TP68
TP65
C185 10uF 50v
R306 270R 1%
C180 390pF 2%
C603 10pF
C182 100pF 2%
C186 10uF 50v
C176 100uF
C178 47pF
LK269
R319 470R
C177 470uF
R323 0R0
LK201
+12V
LK273 2V4 5%
LK73
+5VAHS
OFF3
PL33-1 N/F
R789 Not Fitted For MAC
R789 0R0
PL33-3 N/F
+5V
R625 15K
C293 10uF 50v
R327 1K0
TP54
R324 2K7
TP55
Q54 BC846B
Q55 BC856B
TP125
TP49
R323 100R
R326 330R
R325 680R
R592 0R0
TP53
R328 75R
OF1
R626 10K
LK227
LK279
L41 18uH
C608 100uF
U32 74HC4053
+5V
L47 18uH
+5VAHS
R444 2K2 1%
R445 1K0
LK6 0R0 N/F
MAC3
LK154
PL27-2 N/F
LK6 Not Fitted For VIDEOCRYPT
+5VN
C592 33pF
C179 100nF 20/80% 25V
C254 100nF 20/80% 25V
C255 100nF 25V 20/80%
L16 15uH 5%
C291 220nF 25V 20/80%
R329 150R
Q56 BC846B
SK3-40
R330 75R
PL30-12 N/F
TP67
TP61
R331 1K0
R14 150R
LK68
PL30-14 N/F
+5VAHS
C253 100nF 25V 20/80%
R442 1K0
R443 4K7
LK69
+12VC
R334 220R
TP70
TP73
R332 220R
C582 10pF
C192 180pF
Q58 BC856B
L18 3u3H
X7 N/F
R336 390R
C193 N/F
Q57 BC846B
R333 270R 1%
R335 270R 1%
R337 820R
Q59 BC856B
+12VC
TP194
R825 1K0
Q117 BC846B
TP192
C520 330pF
C194 470nF 63V POLY
+12VC
R829 100K
R826 1K0
C619 47nF 10%
Q100 BC856B
TP193
+5VN
C621 100nF
R827 220K
R828 100K
Q118 ZVN3306F
C622 100nF
TP190
TP191
R18 2K2
L19 33uH 5%
R824 2K2
R523 10K
Q78 ZVN3306A
D68 BAS16
R712 470K
C588 10nF 10%
LK64
STATION_ID
+5VN
LK197
LK209
R339 2K2
R340 5R6
C198 10uF 50V
R346 330R
R539 470R N/F
TP111
LK211
LK230
R437 1K0
Q98 BC856B
VREF
TP2
C42 5p6F +-0p25F
C199 18pF
L20 15uH 5%
L21 18uH 5%
R63 390R
C215 22pF
C211 68pF
C212 27pF
R66 1K0
Q15 BC846B
R67 220R
+12V
R65 2K2 1%
R64 120R
TP105
LK155
Q14 BC856B
R62 620R
DVIDEO
C28 100pF
MAC4
MAC5
PL33-4 N/F
MAC N/F
MAC8
R345 100R
+12VC
Q62 BC846B
R150 0R0
LK221
R262 12K
+5V
L23 WIRE LINK
PL33-6
PL33-7
R265 2K2 1%
C149 100uF
C148 100nF 25V 20/80%
PL33-10
+5VDS
C147 10uF 50V
R812 0R0
+5VDS
R637 N/F
TP112
LK151
LK159
LK280
LK281
R729 0R0
PL33-8 N/F
LK239
U30PIN4
J3
U30PIN14
J2
RST
C110 220nF 25V 20/80%
C128 10uF 50v
R216 12K
C130 220pF
U19C TL084
R215 4K7
R671 0R0
L49 100uH
AUDIO_MOD
U18 MSP3400C-C6
R781 0R0
C126 2n2F
C127 2n2F
R212 22K
R211 22K
33 MOD R
34 MOD L
J1
J4
C611 270pF
C612 270pF
U19D TL084
C609 22uF 35V
C610 470uF
-8V
LK291
C509 1uF
RT
LT
R642 100K
R643 10K
R644 4K7
C510 100pF
C213 1nF
C214 1nF
LK290
C507 1uF
U19A TL084
LK141
LK240
C122 10uF 105°C 50V
C123 10uF 105°C 50V
TP13
+5VA
LK161
LK284
C121 1nF
L22 18uH
C120 1nF
C108 100nF 25V 20/80%
R639 100K
R640 10K
R641 4K7
C508 100pF
LK236
LK237
R650 68R
C514 56pF
C516 220nF 25V 20/80%
C515 22pF
R649 10K
L25 12uH 5% 19MHZ
R652 0R0
R648 9K1
C109 56pF
Q104 BFR193
C614 39pF
C163 39pF
LK145
R559 75R
R548
TP134
R210 33R 0W5 5%
TP130
C513 N/F
R646 68R
R647 4K7
C615 270pF
R610 18K 1%
L53 12uH 5% 19MHZ
X8 CERAMIC TRAP TPS 4.43MJ
C119 100nF 25V 20/80%
D38 8V2 2%
C252 100nF 25V 20/80%
X2 18.432MHz
C111 10uF 50v
C112 100nF 25V 20/80%
LK146
C113 10pF
C114 10pF
LK228
C115 470pF 10%
TP83
C116 470pF 10%
C117 3u3F 50V
C118 100nF 25V 20/80%
* = DENOTES STAR GROUND CONNECTION
PL33-9 N/F
+5V
Q116 BC846B
U30 HEF 4053
R111 10K
R112 100K
U21.1
VCR
LK232
VID_OUT
SAT
R819 0R0
R436 J3
R435 J2
D62 8V2 2%
LK47
LK143
LK241
LK306
R645 220R 5W 5% PRD. 820R 0W25 1% PSR. DUAL PITCHED RESISTOR REF R645A
-21V
C512 100nF 20/80% 25V
-8V
R818 0R0
LK10 0R0 N/F
LK9 0R0 N/F
LK319
LK318 N/F
R820 0R0
LK8 N/F
LK231
U18-4
H=SAT
L=VCR
MOD_VID_SRC
SPEAKER_SEL
LK191
LK212
R668 0R0
L-IN
R-IN
TP147
R731 330R
+12V
TP149
R733 N/F
Q108 N/F
Q61 BC846B
R732 0R0
R343 75R
TP148
TP52
R342 330R
L45 IS SDL4751 FOR PAL G ONLY AND A WIRE-LINK OTHERWISE
L45 SDL4751
OR
L45
OF10
TO MODULATOR
R781 0R0
R782 0R0
LK262
LK260
LK253
LK148
LK242
LK294
R755 0R0
R760 0R0
R783 0R0
R784 0R0
PHONOGND
C601 330nF 25V 20/80%
LK266
PD9-528-A
HAND MOD WIRE (0.5 X 30MM RED)
+12V
C16 100nF 25V 20/80%
C15 1000uF
LNBSPLY
C505 100uF
C506 100nF 25V 20/80%
-8V
LK16
LK39
D15
+30V
+30V
D17 BAS16
R31 1K 1%
Q5 BC846B
TP107
U3A LM358/KA358
D14 BAS16
R51 4K7
+5V
R419 1K0
R23 22K
R22 10K
R52 5K6
R34 2K7 1%
C273 470pF 10%
R37 5K6 1%
TP98
TP97
R25 4K7
H/V_POLARITY
Q6 BC846B
LK25
TP99
LNB_ON/OFF
BC846B Q72
R30 4K7
R29 4K7
LNB_SHORT
R24 4K7
D21 4V7
FP-FILAMENT
LK45
Q12 BC846B
TONE

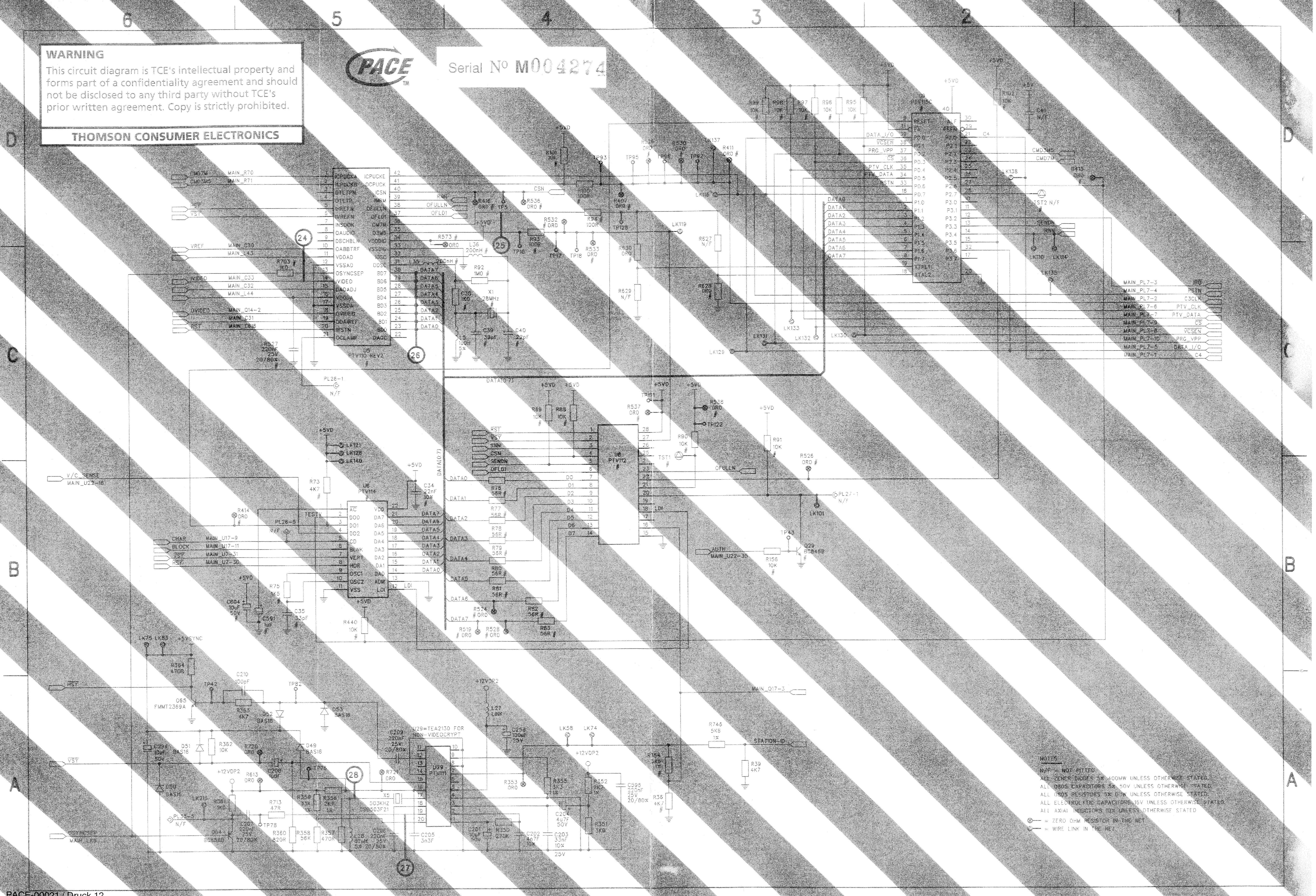
2
1
D
C
B
PACE
EOCRYPT
AREA.
U9-12
U9-33
R100
U9-35
U9-36
U9-38
U9-37
U9-39
U9-34
U9-21
IRQ
RSTN
C3CLK
PTV_CLK
CS
VCSEN
PRG_VPP
DATA_I/O
PTV_DATA
C4
U5-20 U8-1
RST
U8-18
+5VD
R155 N/F
R154 N/F
LK136
LK134
R450 0R0 N/F
PL7-3
PL7-4
PL7-2
PL7-6
PL7-11
PL7-7
PL7-9
PL7-8
PL7-10
PL7-5
PL7-1
TO CARD READERS
PL7
FE CONNECTOR 11WAY
TOP ENTRY
R506 0R0
R417 0R0
R763 0R0
TP164
C616 220nF 25V 20/80%
LK107
LK296
LK297
LK298
LK307
LK308
FP_FILAMENT
FP_CLK
FP/MAC_DATA
FP/MAC_INT
+12VUNREG
+5VMOD
+5V
-21V
PL2-10
PL2-9
PL2-8
PL2-7
PL2-6
PL2-5
PL2-4
PL2-3
PL2-2
PL2-1
FRONT PANEL
PL2
FE CONNECTOR 10WAY
TOP ENTRY
+5VA
R590 0R0
R611 0R0
03.3
NOISE-SEL
L-IN
R-IN
SPEAKER_SEL
+8V
-8V
PL4-3
PL4-2
PL4-4
PL4-7
PL4-6
PL4-8
PL4-5
PL4-1
PL4-9
SOUND PCB
PL4
FE CONNECTOR 9WAY
TOP ENTRY
R774 0R0
LK300
DPLD-SCL1
R657 0R0
SURROUNDCLK
COMMON_CLK
DATA
SCL
J5 N/F
SCLSOUND
LK311
LK312
R773 0R0
PL3-7
PL3-6
PL3-5
PL3-4
PL3-3
PL3-2
PL3-1
SOUND PCB
PL3
FE CONNECTOR 7WAY
TOP ENTRY
LK86
LK103
LK313
LK314
R385 0R0
R791 0R0
R790 0R0
R85 4K7
R86 4K7
TP159
TP71
Q17 BC846B
+30V
TP140
R780 0R0
R743 12K
R740 4K7
R742 1K
Q111 BC846B
Q110 BC846B
TP150
TP151
R741 820R
R105 220K
C594 10uF 50V
R106 47K
TP166
TP167
Q115 BC846B
TP172
R404 0R0
R104 22K
R103 4K7
Q114 FXT749
CARDSEL1
CD_DET
+12VDP2
LK71
LK87
LK70
LK88
LK51
LK85
LK90
LK93
L51 LINK
PL12-1
PL12-2
PL12-3
PL12-4
PL12-5
PL12-6
PL12-7
PL12-8
TO CARD READERS
PL12
FE CONNECTOR 8WAY
TOP ENTRY
PL30-7
PL30-11
PL30-13
NOT FITTED
PL33-2
NOT FITTED
R830 0R0
+5VSYNC
U17 74HC4053
R708 100R FOR NON-VIDEOCRYPT
R708 0R0
TP114
R541 470R
TP115
R542 470R
Q101 BC856B
C200 1uF M/Layer 50V
D48 BAS16
C586 22uF
R707 3K3 1%
R706 1K5
R348 100R
Q63 BC846B
R347 100K
TP74
C581 10uF 50V
C595 220nF 25V 20/80%
3V
2V
R207 3K3 1%
L52 R/F BEAD
R349 560R
C401 N/F
R420 560R
TP138
PL30-4
+5VAHS
R705 330R
LK76
OFF3
Q105 BC856B
03.3
R599
R534 0R0
LK125
LK157
PL26-4 N/F
BLOCK
CHAR
IVIDEO
LK156
LK126
R535 0R0
R799 0R0
R596 0R0
L31 18UH
C44 22nF 10%
C587 1uF M/Layer 50V
LK3
LK48
LK4
LK12
LK41
LK23
LK92
LK206
LK217
LK210
LK205
LK204
LK184
LK160
LK233
LK120
LK118
LK122
LK127
LK13
LK14
LK17
LK20
LK24
LK27
LK43
LK50
LK139
LK149
LK186
LK235
LK238
LK248
LK29
LK30
LK32
LK36
LK37
LK38
LK96
LK168
LK189
LK244
LK317 N/F
LK287
R545 0R0
R561 0R0
R572 0R0
R727 0R0
R795 0R0
R800 N/F
R823
PL10-1
PL10-2
PL10-3
PL10-4
NOT FITTED
PL11-2
PL11-8
PL11-11
PL11-12
PL-11 N/F FOR VIDEOCRYPT


POWER SUPPLY
SOUND PCB
PL4
FE CONNECTOR 9WAY
TOP ENTRY
SOUND PCB
PL3
FE CONNECTOR 7WAY
TOP ENTRY
TO CARD READERS
PL12
FE CONNECTOR 8WAY
TOP ENTRY
NOISE_SEL
L-IN
R-IN
SPEAKER_SEL
DPLD-SCL1
SURROUNDCLK
COMMON_CLK
DATA
SCL
SCLSOUND
CARDSEL1
CD_DET
RST
NOT FITTED
PL-11 N/F FOR VIDEOCRYPT
U8-16
Q17 BC846B
U17 74HC4053
R708 100R FOR NON-VIDEOCRYPT
Q101 BC856B
Q63 BC846B
Q105 BC856B
Q114 FXT749
Q111 BC846B
Q110 BC846B
Q115 BC846B
OFF3
Q3.3
IVIDEO
BLOCK
CHAR
TUNING_VOLTS
THE FOLLOWING COMPONENTS ARE DUAL PITCHED
C11,C12,C288,D11,D12
CAUTION
T3,T4
DUAL PITCHED
•A• TRANSFORMER-SWITCH MODE FOR MSS1000
OVER-BOARD WIRE-LINK - FITTED FOR DOLBY & DISH-POSITIONER OPTIONS ONLY
PL5 NOT FITTED.
PL38 2WAY FRIC LOCK
ALL NON-FLAMMABLE
ALL RETRO-FITTED
U1 MC3842
U2 PC111LY
Q1 STP4N90FI
FS1 •A• FUSE F1AL FAST BLOW
FS2 •A• FUSE F2AL FAST BLOW
4 X 1N4007
T1 UF2327S4-463V0R6-10
SK1 LEONHARDY •A• 07-78.2300 MAINS INPUT
POWERGND
AGND2
D9 TL431
C
B
A

NOTES :

N/F = NOT FITTED.
ALL ZENER DIODES 5% 400MW UNLESS OTHERWISE STATED.
ALL 0805 CAPACITORS 5% 50V UNLESS OTHERWISE STATED.
ALL 0805 RESISTORS 5% 0.1W UNLESS OTHERWISE STATED.
ALL ELECTROLYTIC CAPACITORS 16V UNLESS OTHERWISE STATED.
ALL AXIAL INDUCTORS 10% UNLESS OTHERWISE STATED.
$ COMPONENTS ADDED FOR NON VIDEOCRYPT.
# COMPONENTS DELETED FOR NON VIDEOCRYPT.
• COMPONENTS FITTED FOR DUAL INPUT RECIVER.

① VALUES ARE FOR THE SHARP TUNER
FOR THE PACE TUNER FIT
R316 AS 8K2,R311 AS 2K2.
② VALUES SHOWN ARE FOR PRD BUILD.
VALUES FOR PSR ARE GIVEN BELOW
R539 470R
COMPONENTS 098,
R437 ARE NOT FITTED.
③ VALUES SHOWN ARE FOR 16MHz MICRO
FOR 8MHz MICRO R431 IS 0R0
AND R432 IS NOT FITTED
④ R547, FITTED (680R) ONLY WHEN
WIDE BAND (36Mhz) TUNER IS USED
⑤ INDUCTORS MUST BE OF LOW
RESISTANCE i.e. 406 TYPE
⑥ COMPONENTS MAY BE FITTED ON


6
5
4
3
2
1
D
C
B
A
PACE
Serial Nº M004274
U5
PTV110 REV2
U6
PTV114
U8
PTV112
PTV115C
U29
PTV111
U29=TEA2130 FOR NON-VIDEOCRYPT
X1
28MHz
X5
503KHZ
CSB503F21
Q29
BC846B
Q65
FMMT2369A
Q64
BC858B
DATA[0:7]
CMD7M
CMD3M5
RST
VSY
VREF
IVIDEO
OVIDEO
CSN
RNW
OFULLN
OFLD1
SENDN
V/C_SENSE
MAIN_U22-18
CHAR
BLOCK
TSY
HSY
AUTH
MAIN_U22-35
MAIN_Q17-3
STATION_ID
OSYNCSEP
MAIN_L63
MAIN_PL7-3
MAIN_PL7-4
MAIN_PL7-2
MAIN_PL7-6
MAIN_PL7-7
MAIN_PL7-9
MAIN_PL8-8
MAIN_PL7-10
MAIN_PL7-5
MAIN_PL7-1
IRQ
RSTN
C3CLK
PTV_CLK
PTV_DATA
CS
VCSEN
PRG_VPP
DATA_I/O
C4
+5VD
+5VSYNC
+12VDP2
24
25
26
27
28

WARNING

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THOMSON CONSUMER ELECTRONICS

NOTES

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ALL ELECTROLYTIC CAPACITORS 16V UNLESS OTHERWISE STATED.

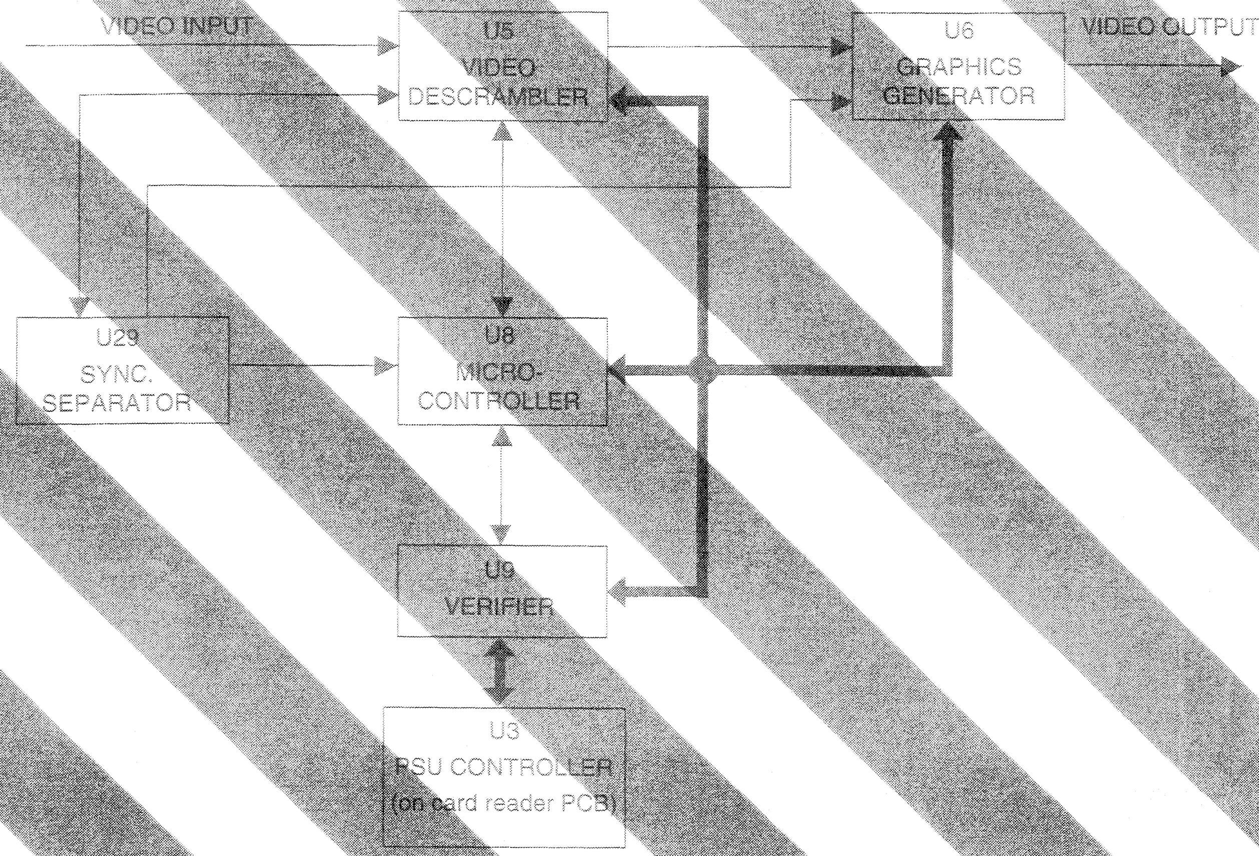
ALL AXIAL INDUCTORS 10% UNLESS OTHERWISE STATED

⊗— = ZERO OHM RESISTOR IN THE NET

○— = WIRE LINK IN THE NET

MSS 1001-I SATELLITE RECEIVER - VIDEOCRYPT INFORMATION FOR SERVICE MANUAL (Manual Part No. 503-1000001)

VIDEOCRYPT BLOCK DIAGRAM AND CIRCUIT DESCRIPTION



Please see the main circuit diagram (separate sheet) and block diagram (page 18) as well as the diagrams on this sheet. The card reader circuit diagram is on the separate sheet but a description is given adjacent.

The video signal from the energy dispersal clamp Q100 (on the main block diagram) is clamped at 2 V black level and is approximately 1.85 V peak-peak (sync. to bar). It is shown by the line labelled IVIDEO on the main circuit diagram and is applied to pin 1 of switch U17 (main circuit diagram) and, via R72, to pin 14 of U5, the video descrambler (on the VideoCrypt circuit diagram).

The video signal will only pass through U17 via pin 1 if it is a non-VideoCrypt signal, as pins 1 and 2 of U17 select between VideoCrypt and non-VideoCrypt signals as follows. The descrambling data on the video input at pin 14 of U5 is stripped by U5 and passes down the common data bus to U6, U8 and U9. This data bus therefore indicates whether the video signal is scrambled and the line (V/C SENSE) emerging from pin 4 of U6 indicates this presence or absence of scrambling to the microprocessor U22 (on the main circuit diagram). R74 is a pull-up resistor on pin 4 of U6. The line V/C SENSE at the main microprocessor U22 causes it to send a control line (via pin 11 of port expander U25 on the main circuit diagram) to pin 10 of switch U17. If scrambling data was present, then the switch will pass video between pins 2 and 15 as shown in the main circuit diagram. If scrambling data was not present, the video passes through between pins 1 and 15. (Note that U17 is a 4053 switch, a diagram of which is on page 21 of the manual.) The video signal routing after U17 is described on page 20 of the manual.

The video input to pin 14 of U5 emerges at pin 18 and passes via R703, Q64, C207, R713 to pin 19 of U29, the sync. separator. U29 uses ceramic resonator X5 to generate horizontal and vertical sync. pulses. If there is a valid signal at pin 19 of U29, these sync. pulses are locked to this incoming video signal.

The sync. pulses (HSY and VSY at pins 12 and 15 respectively of U29) are needed by the graphics generator U7 (see description on page 20) and also by U6. VSY is needed by U8, the microcontroller IC. The presence of a valid video input at pin 19 of U29 causes the line STATION_ID emerging at pin 7 to go high to show it has locked on to a programme. This line has various functions in the video circuitry - see page 21 of the manual.

The video input at pin 14 of U5 is digitised and descrambled before emerging at pin 18, where it is approximately 0.6 V peak-peak. It is fed via emitter follower Q14 into the reconstruction filter around L20 and L21 (see main circuit diagram). The signal is amplified to 2 V peak-peak by Q15, Q16 and associated components. R68 and C28 boost the burst frequencies to compensate for the digitisation process. The video signal is then applied to pin 13 of U17 via R635 (main circuit diagram). U17 controls the VideoCrypt graphics insertion, pins 11 and 9 being the block and char lines from pins 6 and 5 respectively of U6, the VideoCrypt graphics generation IC. The video signal emerges from pin 14 of U17 and re-enters at pin 2, where it will be switched through if (as described above) the control line at pin 10 of U17 indicates it was originally a scrambled signal.

As stated above, U6 generates the block and char control lines to insert the graphics onto the outgoing video. R75 and C35 are a local oscillator which determines the size of the graphics and their position on the screen. To operate properly, U6 needs horizontal and vertical sync. pulses (at pins 8 and 7 respectively) from U29.

U9 is a verifier IC which controls the data and commands for the card reader via the card power supply controller U3 (on the card reader circuit diagram). There is a reset line from pin 3 of U6 (R73 is a pull-up resistor) which enters U9 at pin 9 and resets U9 during a power-up.

The main clock is controlled by X1, a 28 MHz oscillator. This clock is divided to give 7 MHz and 3.5 MHz which are required by U8 (3.5 MHz), U9 (7 MHz) and the card reader board (both 7 MHz and 3.5 MHz).

GRID REFERENCES FOR VIDEOCRYPT CIRCUIT DIAGRAM

* = not fitted

° = actually a capacitor (in a resistor position)

CAPACITORS

C32	C5
C34	B5
C35	B5
C38	C4
C39	C4
C40	C4
C41*	D2
C201	A4
C202	A4
C203	A4
C204	A4
C205	A5
C206	A5
C207	A5
C208	A5
C209	A5
C210	A5
C258	A4
C294	A6
C591	B5
C595	A4
C604	B5

DIODES

D50	A6
D51	A6
D52	A5
D53	A5

INDUCTORS

L5	C4
L27	A4
L28	A5
L35	C5
L36	C4

LINKS

LK58	A4
LK60	B6
LK74	A4
LK84	B6
LK100	B6
LK101	B3
LK110	C2
LK114	C2
LK116	C3
LK119	C3
LK124	B6
LK126	B6
LK129	C3
LK130	C3
LK131	C3
LK132	C3
LK133	C3
LK135	C2
LK137	C3
LK138	C2
LK156	B6
LK216	A6

CONNECTORS

PL26-1*	C6
PL26-2*	B6
PL26-5*	B5
PL27*	B3

TRANSISTORS

Q29	B3
Q64	A6
Q65	A6

RESISTORS

R36	A3
R39	A3
R73	B5
R75	B5
R76	B4
R77	B4
R78	B4
R79	B4
R80	B4
R81	B4
R82	B4
R83	B4
R88	B4
R89	B4
R90	B3
R91	B3
R92	C4
R93	C4
R94	C4
R95	D3
R96	D3
R97	D3
R98	D3
R99	D3
R100	C4
R101	C4
R102	D2
R156	B3
R350	A4
R351	A4
R352	A4
R353	A4
R354	A3
R355	A4
R356	A5
R357	A5
R358	A5
R359	A5
R360	A5
R361	A6
R362	A6
R363	A5
R364	B5
R407	C4
R411	C3
R413	C2
R414	B6
R416	C4
R440	B5
R519	B4
R524	B4
R526	B3
R527°	C5
R528	B4
R529	C4
R530	C3
R532	C4
R533	C4
R536	C4
R537	B4
R538	B3
R573	C5
R613	A5
R627	C3
R628*	C3
R629	C4
R630*	C4
R703	C5
R713	A5
R720	A5
R721	A5
R746	A3

ICS

U5	C5
U6	B5
U8	B4
U9	C2
U29	A5

MISC. COMPONENTS

TST1	B3
TST2*	C2
X1	C4
X5	A5

INTERCONNECTIONS

(WITHIN THIS CIRCUIT)

CMD3M5	C2, D6
CMD7M	C2, D6
CSN	B4, D4
HSY	B6, D6
OFLD1	B4, D4
OFULLN	B3, D4
RNN	C3, D2, D4
RST	C3, C6
SENDN	B4, D2
VSY	B6, D6

(TO MAIN CIRCUITRY)

MAIN_C30 (VREF)	C6
MAIN_C31	C6
MAIN_C616 (RST)	C6
MAIN_L43	C6
MAIN_L44	C6
MAIN_PL7-1 (C4)	C1
MAIN_PL7-2 (C3CLK)	C1
MAIN_PL7-3 (IRQ)	C1
MAIN_PL7-4 (RSTN)	C1
MAIN_PL7-5 (DATA-I/O)	C1
MAIN_PL7-6 (PTV-CLK)	C1
MAIN_PL7-7 (PTV-DATA)	C1
MAIN_PL7-8 (VCSEN)	C1
MAIN_PL7-9 (CS)	C1
MAIN_PL7-10 (PRG-VPP)	C1
MAIN_Q14-2 (OVIDEO)	C6
MAIN_Q17-3	B3
MAIN_Q64-2 (OSYNCSEP)	C6
MAIN_R72 (IVIDEO)	C6
MAIN_U7.30 (HSY)	B6
MAIN_U7.31 (VSY)	B6
MAIN_U17.9 (CHAR)	B6
MAIN_U17.11 (BLOCK)	B6
MAIN_U22.16 (V/C SENSE)	B6
MAIN_U22.35 (AUTH)	B3

CARD READER DESCRIPTION (CARD READER PCB)

Please see the circuit diagram for the card reader board on the separate sheet.

Most of the signals pass between the card reader board and main board via a ribbon cable between PL7 on the main board and PL1 on the card reader board. The control lines CARDSEL1 and CD_DET enter via the ribbon cable between PL12 on the main board and PL2 on the card reader board.

All the signals to the two card readers are multplexed by ICs U1 and U2, under the control of the microprocessor U22 (on the main board) via the CARDSEL1 line from pin 26 of U22. Note that U1 and U2 are 4053 switches; a diagram is given on page 21 of the manual.

The 3.5 MHz clock to the cards (C3CLK) is buffered by U4B before being applied to the cards by U1. The line C4 is not used.

When a card is inserted into card reader 1, the card switch is opened and a signal goes via pin 12 and pin 14 of U2 (which is under the control of the CARDSEL1 line). This pulls pin 17 of U3 high to indicate the presence of a card (the CD_DET line). For card reader 2 the signal goes via pin 13 and pin 14 of U2.

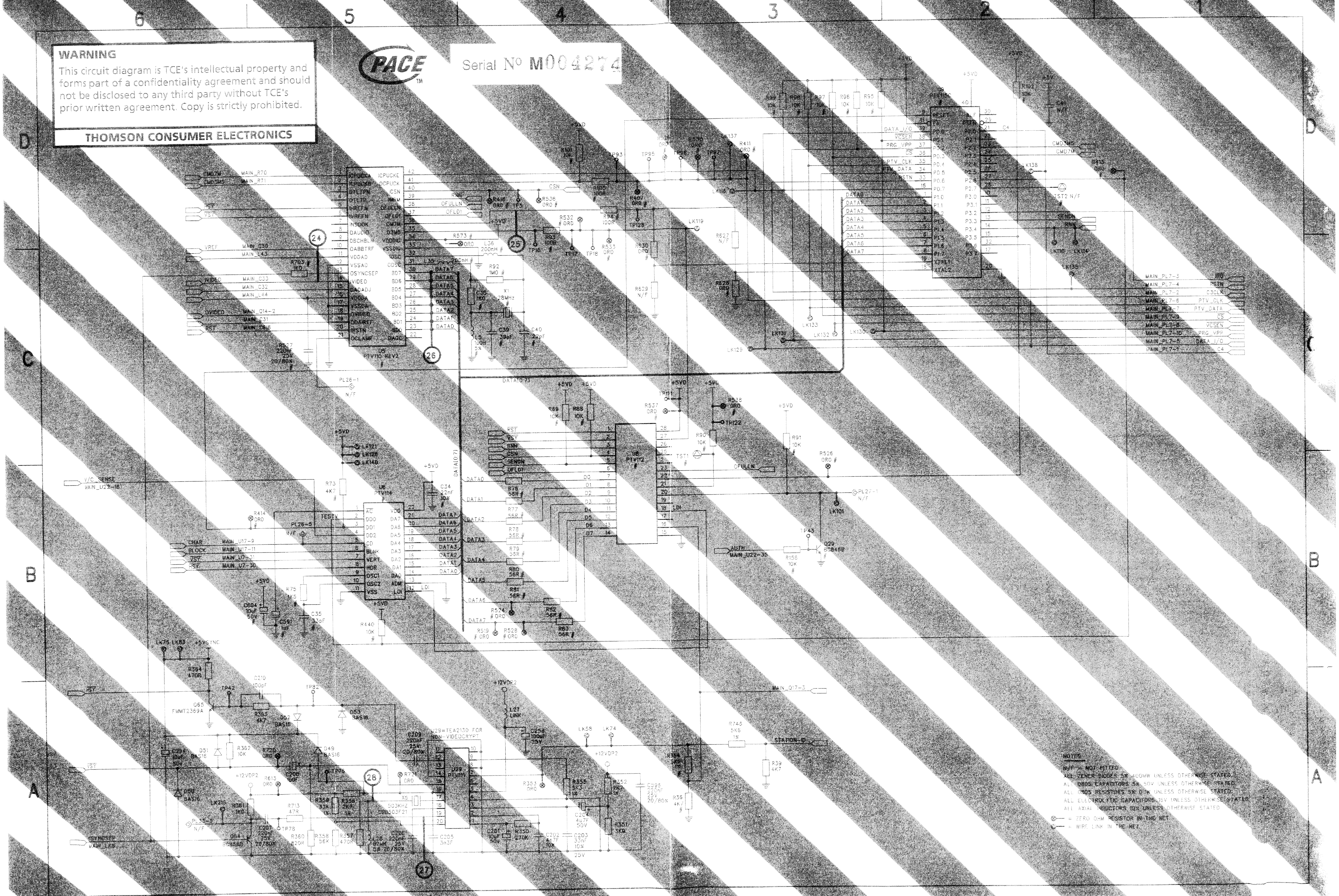
The CD_DET line can also be pulled low for a short duration (approx. 4 ms) by the microprocessor U22 (pin 27) and Q74 (see the main board circuit diagram). This only occurs when there is switching between card 1 and card 2 (either under user control at the Card Menu or when a change of programme causes a change of card) and ensures that the switching is done correctly.

If U3 on the card reader board detects the presence of a card and verifier U9 on the main board (VideoCrypt circuit diagram) determines that the card needs to be addressed, then a data line from U9 commands U3 to apply power (VCC and VPP) to the card.

For card 1, VCC goes to 5 V and is applied via Q4 to the card. Q4 is switched via R6, R39, Q2 and pin 2 of U1 (pins 2 and 1 of U1 determine whether card 1 or card 2 respectively receives VCC). VPP is also initially 5 V and this passes to card 1 via Q8, which is switched by Q7 and associated components. Q7 cannot be turned on until Q4 is conducting VCC, so VPP cannot be at the card unless VCC is also present.

For card 2, VCC goes to 5 V and is applied via Q3 to the card. Q3 is switched via R7, R37, Q1 and pin 1 of U1. VPP is also initially 5 V and this passes to card 2 via Q6, which is switched by Q5 and associated components. Q5 cannot be turned on until Q3 is conducting VCC.

Data and clock should also be present at the cards before communication can take place. Diodes D1 to D8 provide protection for the control lines RSTN, DATA I/O, C3CLK and C4 to keep them in the range 0 to 5 V.



6
5
4
3
2
1
D
C
B
A
PACE
TM
U5
PTV110 REV2
U6
PTV114
U8
PTV112
U9
PTV115C
U29
PTV111
U29=TEA2130 FOR NON-VIDEOCRYPT
X1
28MHz
X5
503KHZ
SBB503F21
Q55
FMMT2369A
Q64
BC858B
Q29
BC848B
D49
BAS16
D50
BAS16
D51
BAS16
D52
BAS16
D53
BAS16
MAIN_R70
MAIN_R71
MAIN_C30
MAIN_L43
MAIN_C33
MAIN_C32
MAIN_L44
MAIN_Q14-2
MAIN_C31
MAIN_C816
MAIN_U22-16
MAIN_U17-9
MAIN_U17-11
MAIN_U7-31
MAIN_U7-30
MAIN_U22-35
MAIN_Q17-3
MAIN_PL7-3
MAIN_PL7-4
MAIN_PL7-2
MAIN_PL7-6
MAIN_PL7-7
MAIN_PL7-9
MAIN_PL7-8
MAIN_PL7-10
MAIN_PL7-5
MAIN_PL7-1
DATA0
DATA1
DATA2
DATA3
DATA4
DATA5
DATA6
DATA7
DATA[0-7]
V/C_SENSE
CHAR
BLOCK
VST
FST
AUTH
STATION-ID
CSN
RNW
SENDN
OFULLN
OFLD1
RST
VREF
VIDEO
QVIDEO
CMD3MS
CMD7M
C3CLK
PTV_CLK
PTV_DATA
PRG_VPP
VCSEN
DATA_I/O
C4
+5VD
+12VDP2
+5VSYNC
TESTY
LD1
24
25
26
27
28

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THOMSON CONSUMER ELECTRONICS

Serial N° M004274

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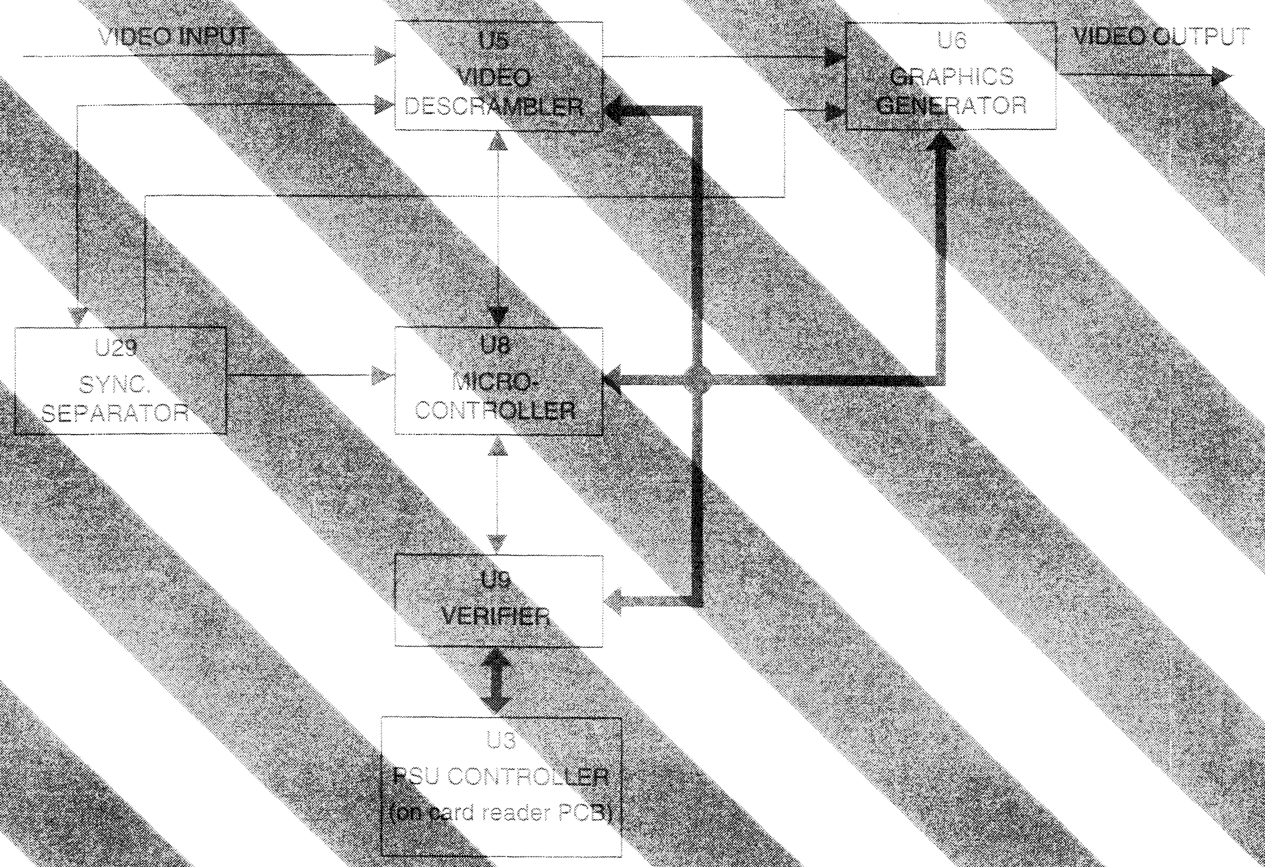
= WIRE LINK IN THE NET

MSS 1001-I SATELLITE RECEIVER - VIDEOCRYPT INFORMATION FOR SERVICE MANUAL (Manual Part No. 503-1000001)

VIDEOCRYPT BLOCK DIAGRAM AND CIRCUIT DESCRIPTION



Please see the main circuit diagram (separate sheet) and block diagram (page 18) as well as the diagrams on this sheet. The card reader circuit diagram is on the separate sheet but a description is given adjacent.

The video signal from the energy dispersal clamp Q100 (on the main block diagram) is clamped at 2 V black level and is approximately 1.85 V peak-peak (sync. to bar). It is shown by the line labelled IVIDEO on the main circuit diagram and is applied to pin 1 of switch U17 (main circuit diagram) and, via R72, to pin 14 of U5, the video descrambler (on the VideoCrypt circuit diagram).

The video signal will only pass through U17 via pin 1 if it is a non-VideoCrypt signal, as pins 1 and 2 of U17 select between VideoCrypt and non-VideoCrypt signals as follows. The descrambling data on the video input at pin 14 of U5 is stripped by U6 and passes down the common data bus to U6, U8 and U9. This data bus therefore indicates whether the video signal is scrambled and the line (V/C SENSE) emerging from pin 4 of U6 indicates this presence or absence of scrambling to the microprocessor U22 (on the main circuit diagram). R74 is a pull-up resistor on pin 4 of U6. The line V/C SENSE at the main microprocessor U22 causes it to send a control line (via pin 11 of port expander U25 on the main circuit diagram) to pin 10 of switch U17. If scrambling data was present, then the switch will pass video between pins 2 and 15 as shown in the main circuit diagram. If scrambling data was not present, the video passes through between pins 1 and 15. (Note that U17 is a 4053 switch, a diagram of which is on page 21 of the manual.) The video signal routing after U17 is described on page 20 of the manual.

The video input to pin 14 of U5 emerges at pin 18 and passes via R703, Q64, C207, R713 to pin 19 of U29, the sync. separator. U29 uses ceramic resonator X5 to generate horizontal and vertical sync. pulses. If there is a valid signal at pin 19 of U29, these sync. pulses are locked to this incoming video signal.

The sync. pulses (HSY and VSY at pins 12 and 15 respectively of U29) are needed by the graphics generator U7 (see description on page 20) and also by U6. VSY is needed by U8, the microcontroller IC. The presence of a valid video input at pin 19 of U29 causes the line STATION_ID emerging at pin 7 to go high to show it has locked on to a programme. This line has various functions in the video circuitry - see page 21 of the manual.

The video input at pin 14 of U5 is digitised and descrambled before emerging at pin 18, where it is approximately 0.6 V peak-peak. It is fed via emitter follower Q14 into the reconstruction filter around L20 and L21 (see main circuit diagram). The signal is amplified to 2 V peak-peak by Q15, Q16 and associated components. R68 and C28 boost the burst frequencies to compensate for the digitisation process. The video signal is then applied to pin 13 of U17 via R635 (main circuit diagram). U17 controls the VideoCrypt graphics insertion, pins 11 and 9 being the block and char lines from pins 6 and 5 respectively of U6, the VideoCrypt graphics generation IC. The video signal emerges from pin 14 of U17 and re-enters at pin 2, where it will be switched through if (as described above) the control line at pin 10 of U17 indicates it was originally a scrambled signal.

As stated above, U6 generates the block and char control lines to insert the graphics onto the outgoing video. R75 and C35 are a local oscillator which determines the size of the graphics and their position on the screen. To operate properly, U6 needs horizontal and vertical sync. pulses (at pins 8 and 7 respectively) from U29.

U9 is a verifier IC which controls the data and commands for the card reader via the card power supply controller U3 (on the card reader circuit diagram). There is a reset line from pin 3 of U6 (R73 is a pull-up resistor) which enters U9 at pin 9 and resets U9 during a power-up.

The main clock is controlled by X1, a 28 MHz oscillator. This clock is divided to give 7 MHz and 3.5 MHz which are required by U6 (3.5 MHz), U9 (7 MHz) and the card reader board (both 7 MHz and 3.5 MHz).

GRID REFERENCES FOR VIDEOCRYPT CIRCUIT DIAGRAM

* = not fitted

° = actually a capacitor (in a resistor position)

CAPACITORS

C32	C5
C34	B5
C35	B5
C38	C4
C39	C4
C40	C4
C41*	D2
C201	A4
C202	A4
C203	A4
C204	A4
C205	A5
C206	A5
C207	A5
C208	A5
C209	A5
C210	A5
C258	A4
C294	A6
C591	B5
C595	A4
C604	B5

DIODES

D50	A6
D51	A6
D52	A5
D53	A5

INDUCTORS

L5	C4
L27	A4
L28	A5
L35	C5
L36	C4

LINKS

LK58	A4
LK60	B6
LK74	A4
LK84	B6
LK100	B6
LK101	B3
LK110	C2
LK114	C2
LK116	C3
LK119	C3
LK124	B6
LK126	B6
LK129	C3
LK130	C3
LK131	C3
LK132	C3
LK133	C3
LK135	C2
LK137	C3
LK138	C2
LK156	B6
LK216	A6

CONNECTORS

PL26-1*	C6
PL26-2*	B6
PL26-5*	B5
PL27*	B3

TRANSISTORS

Q29	B3
Q64	A6
Q65	A6

RESISTORS

R36	A3
R39	A3
R73	B5
R75	B5
R76	B4
R77	B4
R78	B4
R79	B4
R80	B4
R81	B4
R82	B4
R83	B4
R88	B4
R89	B4
R90	B3
R91	B3
R92	C4
R93	C4
R94	C4
R95	D3
R96	D3
R97	D3
R98	D3
R99	D3
R100	C4
R101	C4
R102	D2
R156	B3
R350	A4
R351	A4
R352	A4
R353	A4
R354	A3
R355	A4
R356	A5
R357	A5
R358	A5
R359	A5
R360	A5
R361	A6
R362	A6
R363	A5
R364	B5
R407	C4
R411	C3
R413	C2
R414	B6
R416	C4
R440	B5
R519	B4
R524	B4
R526	B3
R527°	C5
R528	B4
R529	C4
R530	C3
R532	C4
R533	C4
R536	C4
R537	B4
R538	B3
R573	C5
R613	A5
R627	C3
R628*	C3
R629	C4
R630*	C4
R703	C5
R713	A5
R720	A5
R721	A5
R746	A3

ICS

U5	C5
U6	B5
U8	B4
U9	C2
U29	A5

MISC. COMPONENTS

TST1	B3
TST2*	C2
X1	C4
X5	A5

INTERCONNECTIONS

(WITHIN THIS CIRCUIT)

CMD3M5	C2, D6
CMD7M	C2, D6
CSN	B4, D4
HSY	B6, D6
OFLD1	B4, D4
OFULLN	B3, D4
RNN	C3, D2, D4
RST	C3, C6
SENDN	B4, D2
VSY	B6, D6

(TO MAIN CIRCUITRY)

MAIN_C30 (VREF)	C6
MAIN_C31	C6
MAIN_C616 (RST)	C6
MAIN_L43	C6
MAIN_L44	C6
MAIN_PL7-1 (C4)	C1
MAIN_PL7-2 (C3CLK)	C1
MAIN_PL7-3 (IRQ)	C1
MAIN_PL7-4 (RSTN)	C1
MAIN_PL7-5 (DATA-I/O)	C1
MAIN_PL7-6 (PTV-CLK)	C1
MAIN_PL7-7 (PTV-DATA)	C1
MAIN_PL7-8 (VCSEN)	C1
MAIN_PL7-9 (CS)	C1
MAIN_PL7-10 (PRG-VPP)	C1
MAIN_Q14-2 (OVIDEO)	C6
MAIN_Q17-3	B3
MAIN_Q64-2 (OSYNCSEP)	C6
MAIN_R72 (IVIDEO)	C6
MAIN_U7.30 (HSY)	B6
MAIN_U7.31 (VSY)	B6
MAIN_U17.9 (CHAR)	B6
MAIN_U17.11 (BLOCK)	B6
MAIN_U22.16 (V.C SENSE)	B6
MAIN_U22.35 (AUTH)	B3

CARD READER DESCRIPTION (CARD READER PCB)

Please see the circuit diagram for the card reader board on the separate sheet.

Most of the signals pass between the card reader board and main board via a ribbon cable between PL7 on the main board and PL1 on the card reader board. The control lines CARDSEL1 and CD_DET enter via the ribbon cable between PL12 on the main board and PL2 on the card reader board.

All the signals to the two card readers are multplexed by ICs U1 and U2, under the control of the microprocessor U22 (on the main board) via the CARDSEL1 line from pin 26 of U22. Note that U1 and U2 are 4053 switches; a diagram is given on page 21 of the manual.

The 3.5 MHz clock to the cards (C3CLK) is buffered by U4B before being applied to the cards by U1. The line C4 is not used.

When a card is inserted into card reader 1, the card switch is opened and a signal goes via pin 12 and pin 14 of U2 (which is under the control of the CARDSEL1 line). This pulls pin 17 of U3 high to indicate the presence of a card (the CD_DET line). For card reader 2 the signal goes via pin 13 and pin 14 of U2.

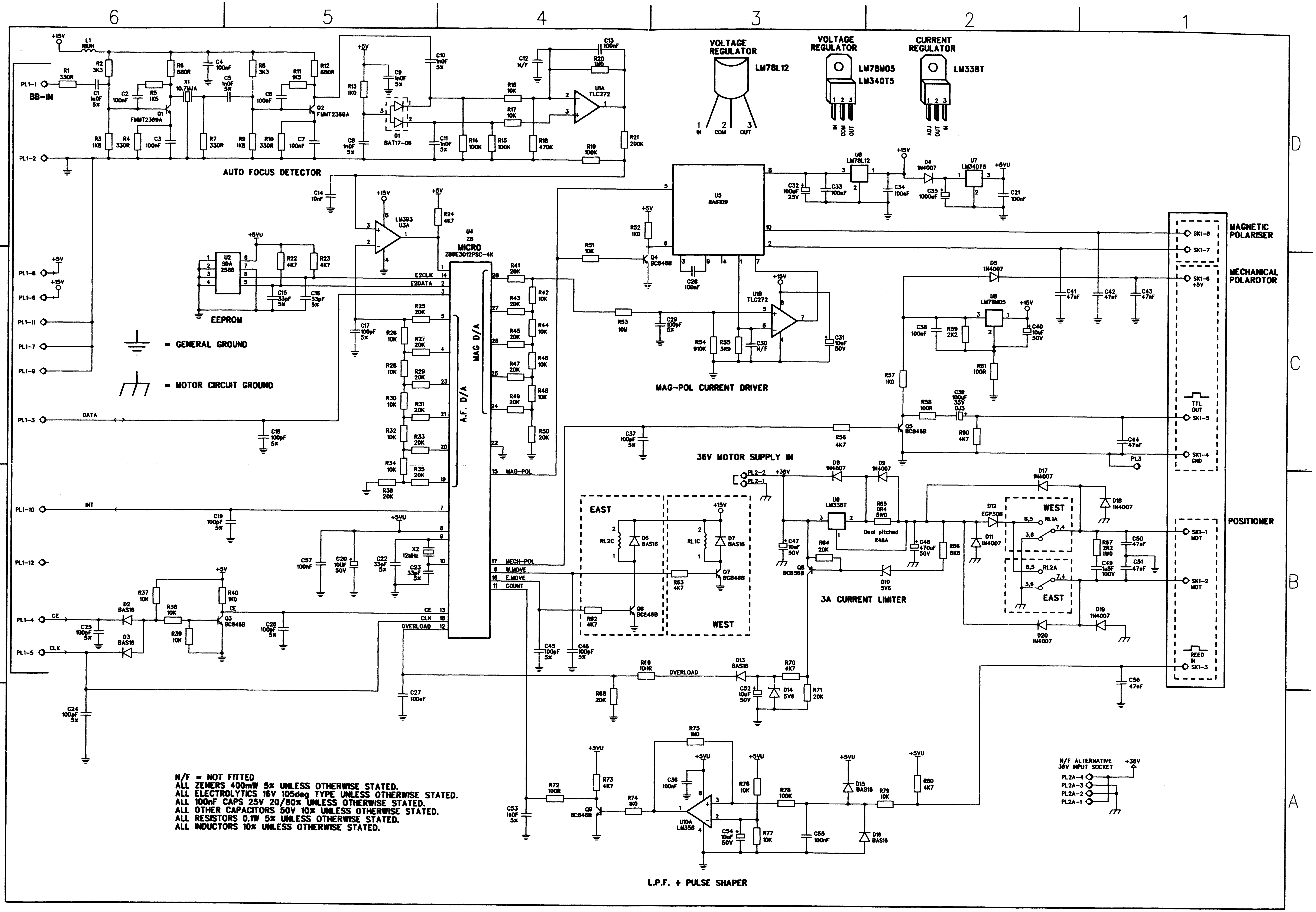
The CD_DET line can also be pulled low for a short duration (approx. 4 ms) by the microprocessor U22 (pin 27) and Q74 (see the main board circuit diagram). This only occurs when there is switching between card 1 and card 2 (either under user control at the Card Menu or when a change of programme causes a change of card) and ensures that the switching is done correctly.

If U3 on the card reader board detects the presence of a card and verifier U9 on the main board (VideoCrypt circuit diagram) determines that the card needs to be addressed, then a data line from U9 commands U3 to apply power (VCC and VPP) to the card.

For card 1, VCC goes to 5 V and is applied via Q4 to the card. Q4 is switched via R6, R39, Q2 and pin 2 of U1 (pins 2 and 1 of U1 determine whether card 1 or card 2 respectively receives VCC). VPP is also initially 5 V and this passes to card 1 via Q8, which is switched by Q7 and associated components. Q7 cannot be turned on until Q4 is conducting VCC, so VPP cannot be at the card unless VCC is also present.

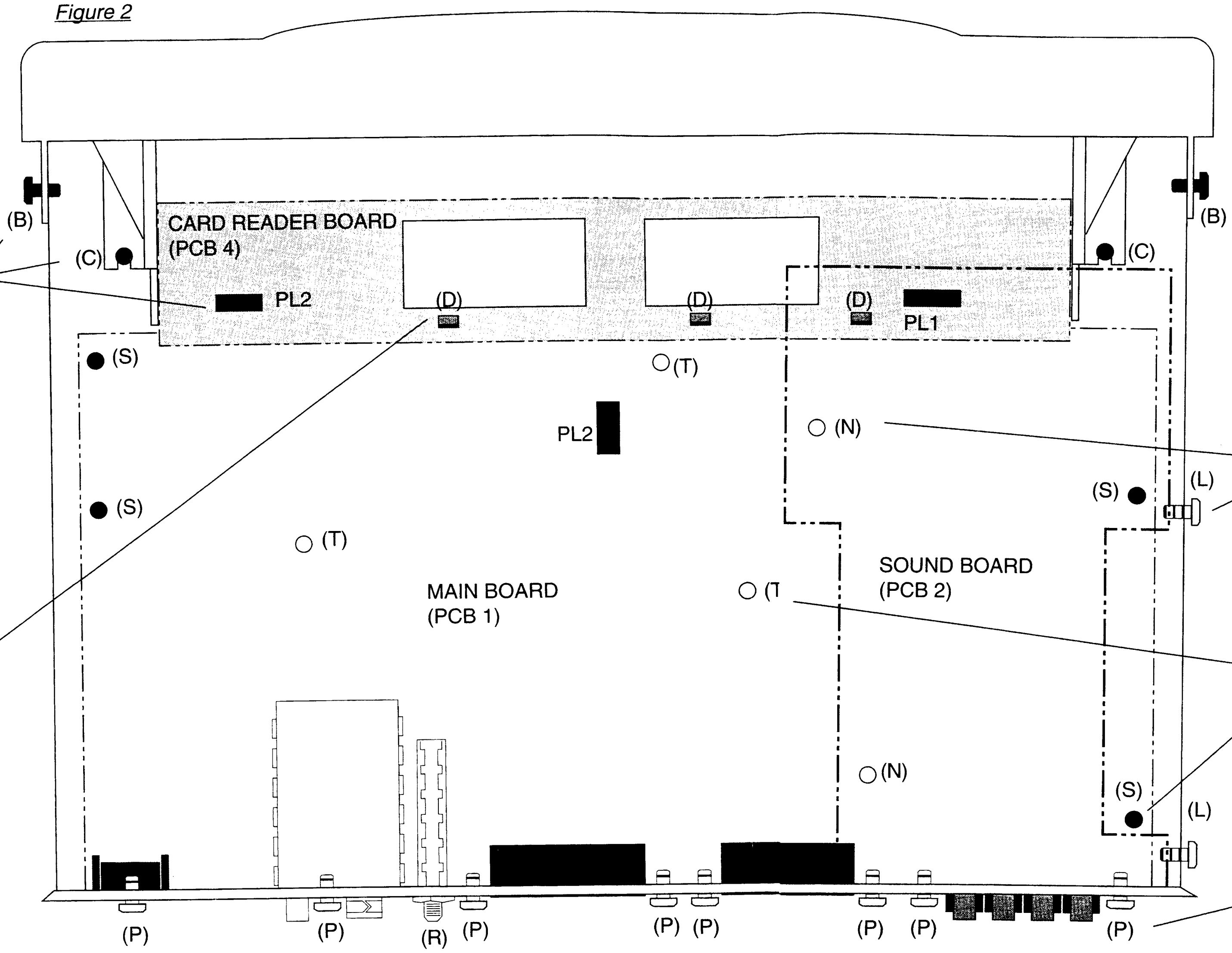
For card 2, VCC goes to 5 V and is applied via Q3 to the card. Q3 is switched via R7, R37, Q1 and pin 1 of U1. VPP is also initially 5 V and this passes to card 2 via Q6, which is switched by Q5 and associated components. Q5 cannot be turned on until Q3 is conducting VCC.

Data and clock should also be present at the cards before communication can take place. Diodes D1 to D8 provide protection for the control lines RSTN, DATA I/O, C3CLK and C4 to keep them in the range 0 to 5 V.


6
5
4
3
2
1
D
C
B
A
AUTO FOCUS DETECTOR
BB-IN
PL1-1
PL1-2
PL1-8
PL1-6
PL1-11
PL1-7
PL1-9
PL1-3
PL1-10
PL1-12
PL1-4
PL1-5
DATA
INT
CE
CLK
+15V
L1 18UH
R1 330R
R2 3K3
R3 1K8
R4 330R
C1 1n0F 5%
C2 100nF
R5 1K5
Q1 FMMT2369A
C3 100nF
R6 680R
X1 10.7MJA
C4 100nF
C5 1n0F 5%
R7 330R
R8 3K3
R9 1K8
C6 100nF
R10 330R
R11 1K5
C7 100nF
R12 680R
Q2 FMMT2369A
C10 1n0F 5%
+5V
R13 1K0
C9 1n0F 5%
C8 1n0F 5%
D1 BAT17-06
C11 1n0F 5%
R14 100K
R15 100K
R16 10K
R17 10K
R18 470K
C12 N/F
C13 100nF
R20 1M0
U1A TLC272
R19 100K
R21 200K
C14 10nF
LM393 U3A
R24 4K7
U4 Z8 MICRO Z86E3012PSC-4K
+5VU
U2 SDA 2586
R22 4K7
R23 4K7
C15 33pF 5%
C16 33pF 5%
EEPROM
E2CLK
E2DATA
C17 100pF 5%
R25 20K
R26 10K
R27 20K
R28 10K
R29 20K
R30 10K
R31 20K
R32 10K
R33 20K
R34 10K
R35 20K
R36 20K
A.F. D/A
MAG D/A
R41 20K
R42 10K
R43 20K
R44 10K
R45 20K
R46 10K
R47 20K
R48 10K
R49 20K
R50 20K
MAG-POL
= GENERAL GROUND
= MOTOR CIRCUIT GROUND
C18 100pF 5%
C19 100pF 5%
C57 100nF
C20 10UF 50V
C22 33pF 5%
X2 12MHz
C23 33pF 5%
MECH-POL
W.MOVE
E.MOVE
COUNT
OVERLOAD
R37 10K
R38 10K
R39 10K
R40 1K0
Q3 BC848B
D2 BAS16
D3 BAS16
C25 100pF 5%
C28 100pF 5%
C24 100pF 5%
C27 100nF
C45 100pF 5%
C46 100pF 5%
VOLTAGE REGULATOR
LM78L12
IN COM OUT
LM78M05
LM340T5
CURRENT REGULATOR
LM338T
ADJ OUT IN
U5 BA6109
R52 1K0
R51 10K
Q4 BC848B
C26 100nF
R53 10M
C29 100pF 5%
R54 910K
R55 3R9
C30 N/F
U18 TLC272
C31 10uF 50V
MAG-POL CURRENT DRIVER
U6 LM78L12
C32 100uF 25V
C33 100nF
C34 100nF
D4 1N4007
U7 LM340T5
C35 1000uF
C21 100nF
MAGNETIC POLARISER
SK1-8
SK1-7
MECHANICAL POLAROTOR
SK1-6 +5V
D5 1N4007
C41 47nF
C42 47nF
C43 47nF
U8 LM78M05
C38 100nF
R59 2K2
C40 10uF 50V
R61 100R
R57 1K0
R58 100R
C39 100uF 35V DJ3
TTL OUT
SK1-5
R56 4K7
Q5 BC848B
R60 4K7
C44 47nF
SK1-4 GND
PL3
C37 100pF 5%
36V MOTOR SUPPLY IN
PL2-2
PL2-1
+36V
D8 1N4007
D9 1N4007
U9 LM338T
R65 0R4 5W0
Dual pitched R48A
C47 10uF 50V
R64 20K
Q8 BC858B
D10 5V6
C48 470uF 50V
R66 6K8
3A CURRENT LIMITER
D17 1N4007
D18 1N4007
D12 EGP30B
D11 1N4007
WEST
RL1A
RL2A
EAST
R67 2R2 1W0
C49 1n5F 100V
C50 47nF
C51 47nF
D19 1N4007
D20 1N4007
POSITIONER
SK1-1 MOT
SK1-2 MOT
REED IN
SK1-3
C56 47nF
EAST
RL2C
D6 BAS16
R62 4K7
Q6 BC848B
WEST
RL1C
D7 BAS16
R63 4K7
Q7 BC848B
R69 100R
R68 20K
D13 BAS16
R70 4K7
C52 10uF 50V
D14 5V6
R71 20K
R75 1M0
C36 100nF
U10A LM358
R72 100R
R73 4K7
Q9 BC848B
R74 1K0
C53 1n0F 5%
C54 10uF 50V
R76 10K
R77 10K
R78 100K
C55 100nF
D15 BAS16
D16 BAS16
R79 10K
R80 4K7
L.P.F. + PULSE SHAPER
N/F ALTERNATIVE 36V INPUT SOCKET
PL2A-4
PL2A-3
PL2A-2
PL2A-1

N/F = NOT FITTED
ALL ZENERS 400mW 5% UNLESS OTHERWISE STATED.
ALL ELECTROLYTICS 16V 105deg TYPE UNLESS OTHERWISE STATED.
ALL 100nF CAPS 25V 20/80% UNLESS OTHERWISE STATED.
ALL OTHER CAPACITORS 50V 10% UNLESS OTHERWISE STATED.
ALL RESISTORS 0.1W 5% UNLESS OTHERWISE STATED.
ALL INDUCTORS 10% UNLESS OTHERWISE STATED.

Figure 2



Removing the Front Panel (Figure 2)

Remove the ribbon cables from PL2 on the main board and PL2 on the card reader board.

Push out the push rivets (B).

Slacken the screws (C) and pull the front panel slightly away from the casing.
Remove the ribbon cable at PL1.

Removing the Card Reader PCB (Figure 2)

Push back each of the 3 clips (D).

Removing the Sound PCB (Figures 1 and 2)

Remove 2 screws (L) on the side of the casing (Figure 2). Remove the 2 screws (M) (Figure 1) by the speaker connectors.

Using tweezers, crimp together the two nylon pillars (N) then pull the PCB gently away from the rear panel (to detach it completely, remove the ribbon cables and power wires which connect it to the main PCB).

To remove the insulating backing from the PCB, push out the 3 push rivets which attach it.

Removing the Main PCB (Figure 2)

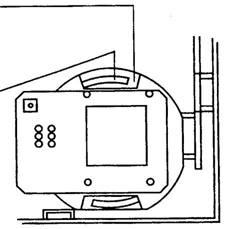
Remove the 8 screws (P) and the nut (R) from the LNB connector (all on the rear panel).

Remove the 4 push rivets (S) at the edges of the main board.

While lifting the front edge of the main PCB, crimp together the stand-off prongs (T) (near the middle of the main board) using tweezers to free the PCB. Gently slide the PCB away from the rear panel.

Removing the Front-panel Dial Potentiometer (Figures 3 and 4)

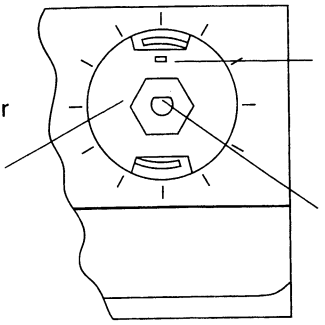
Figure 3



Insert a very small, flat screwdriver into this space and push downwards carefully to push off the dial.

Be very careful NOT to press down on this.

Figure 4



Use a nut runner (NOT pliers) to remove the nut and washer behind the dial.

Note on re-assembly:
There is a small, rectangular anti-rotation peg on the potentiometer which locates in a hole on the inside of the front panel.

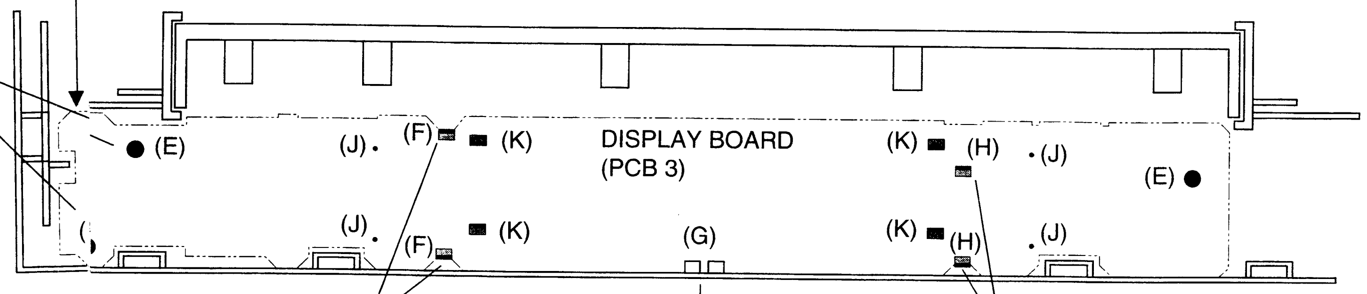
There is a "flat" on the shaft to locate the dial in the correct orientation.

Removing the Display PCB from Insidthe Front Panel (Figure 5)

Start tc the PCB gently here.

Remove the 3 screws (E).

Figure 5



Then pull back these two clips (F) and lift the PCB a little more.

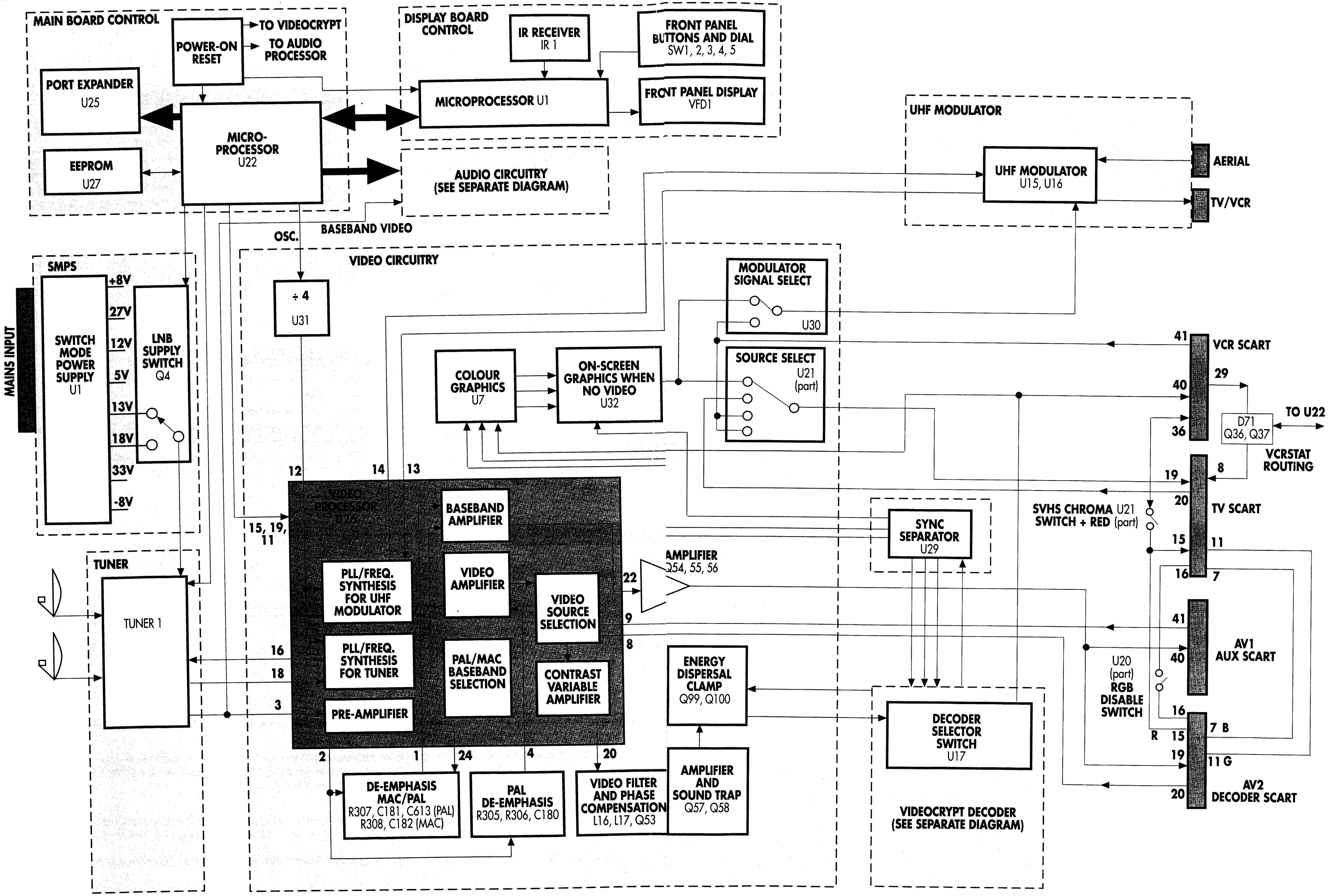
Then gently pull back the top of the front panel moulding slightly to ease the PCB past this point (G).

Finally pull back these two clips (H) to free the PCB.

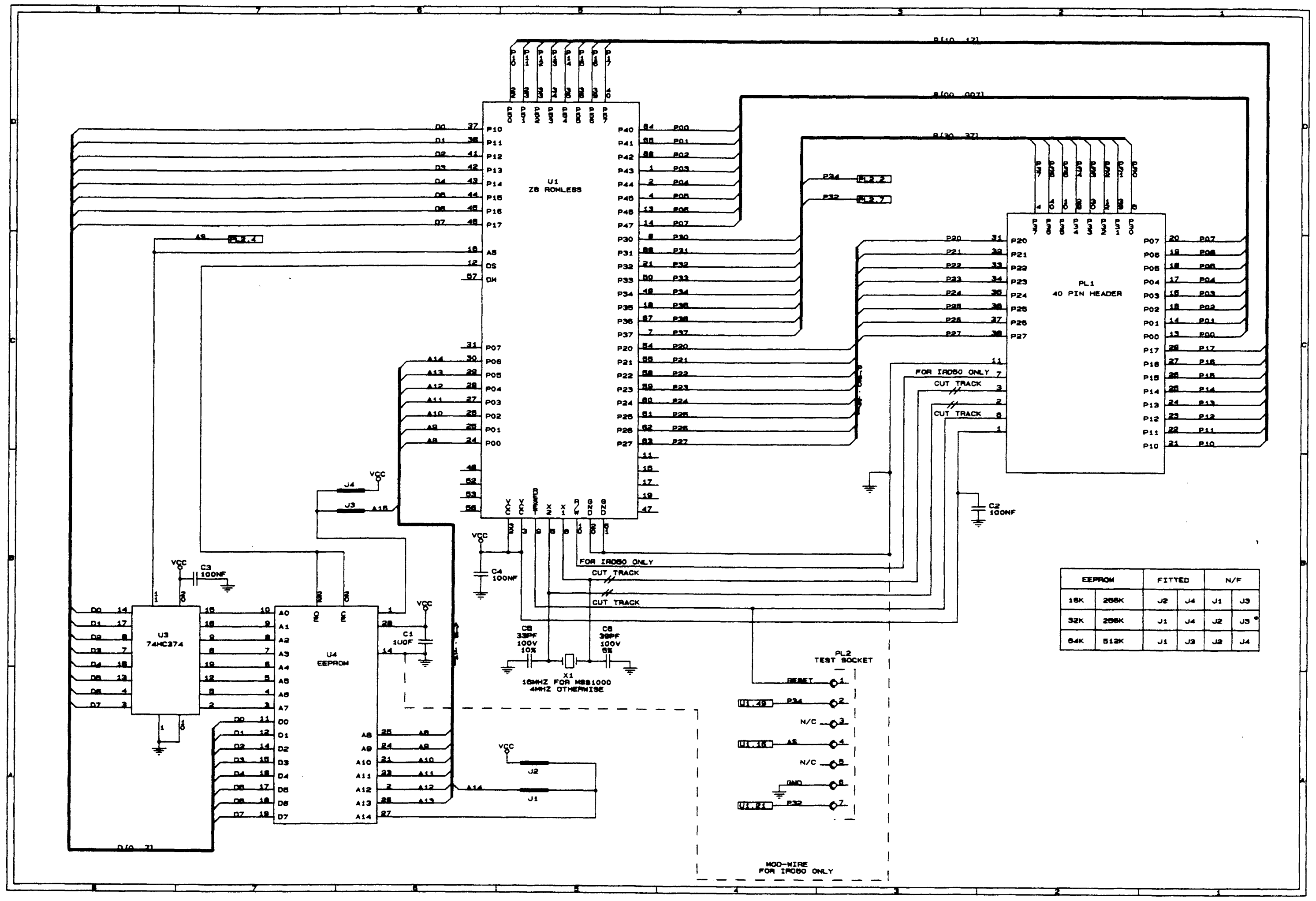
Note o-assembly: Do not try to re-insert the display PCB while the potentiometer is fixed in position. There are 4 small location holes (hich locate on posts inside the front panel moulding. Pull back the top of the moulding gently to ease the PCB past point G.

Note omoving the vacuum fluorescent display from the Display PCB: Pull back the 4 clips (K) (the pins of the display are still soldere the PCB).

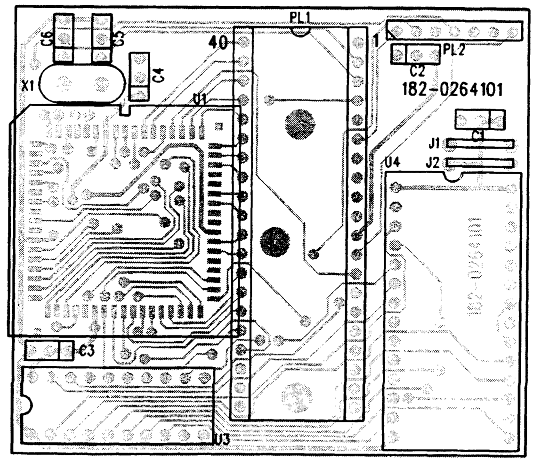
MAIN BLOCK DIAGRAM

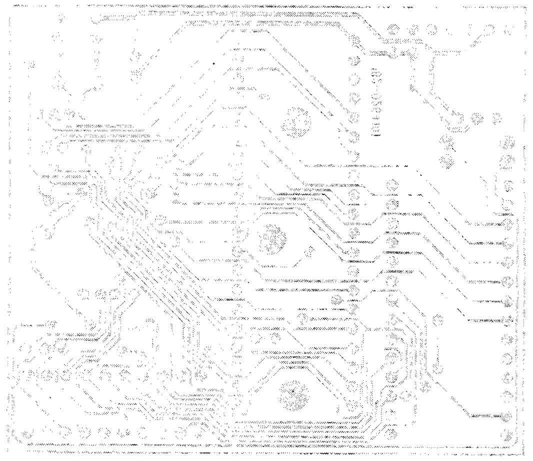

MAIN BOARD CONTROL
POWER-ON RESET
TO VIDEOCRYPT
TO AUDIO PROCESSOR
PORT EXPANDER U25
MICRO-PROCESSOR U22
EEPROM U27
DISPLAY BOARD CONTROL
IR RECEIVER IR 1
FRONT PANEL BUTTONS AND DIAL SW1, 2, 3, 4, 5
MICROPROCESSOR U1
FRONT PANEL DISPLAY VFD1
AUDIO CIRCUITRY (SEE SEPARATE DIAGRAM)
UHF MODULATOR
UHF MODULATOR U15, U16
AERIAL
TV/VCR
OSC.
BASEBAND VIDEO
SMPS
MAINS INPUT
SWITCH MODE POWER SUPPLY U1
+8V
27V
12V
5V
13V
18V
33V
-8V
LNB SUPPLY SWITCH Q4
VIDEO CIRCUITRY
÷ 4
U31
MODULATOR SIGNAL SELECT
U30
SOURCE SELECT
U21 (part)
COLOUR GRAPHICS U7
ON-SCREEN GRAPHICS WHEN NO VIDEO U32
41
VCR SCART
29
40
36
D71 Q36, Q37
TO U22
VCRSTAT ROUTING
8
19
20
TV SCART
15
11
16
7
SVHS CHROMA SWITCH + RED U21 (part)
TUNER
TUNER 1
12
14
13
15, 19, 11
VIDEO PROCESSOR U76
BASEBAND AMPLIFIER
PLL/FREQ. SYNTHESIS FOR UHF MODULATOR
VIDEO AMPLIFIER
VIDEO SOURCE SELECTION
PLL/FREQ. SYNTHESIS FOR TUNER
PAL/MAC BASEBAND SELECTION
CONTRAST VARIABLE AMPLIFIER
PRE-AMPLIFIER
16
18
3
22
9
8
AMPLIFIER Q54, 55, 56
SYNC SEPARATOR U29
41
40
AV1 AUX SCART
U20 (part) RGB DISABLE SWITCH
16
7 B
R
15
19
11 G
20
AV2 DECODER SCART
ENERGY DISPERSAL CLAMP Q99, Q100
DECODER SELECTOR SWITCH U17
2
1
24
4
20
DE-EMPHASIS MAC/PAL R307, C181, C613 (PAL) R308, C182 (MAC)
PAL DE-EMPHASIS R305, R306, C180
VIDEO FILTER AND PHASE COMPENSATION L16, L17, Q53
AMPLIFIER AND SOUND TRAP Q57, Q58
VIDEOCRYPT DECODER (SEE SEPARATE DIAGRAM)

CIRCUIT AND COMPONENT IDENT DIAGRAMS FOR U22 EXTENSION PCB

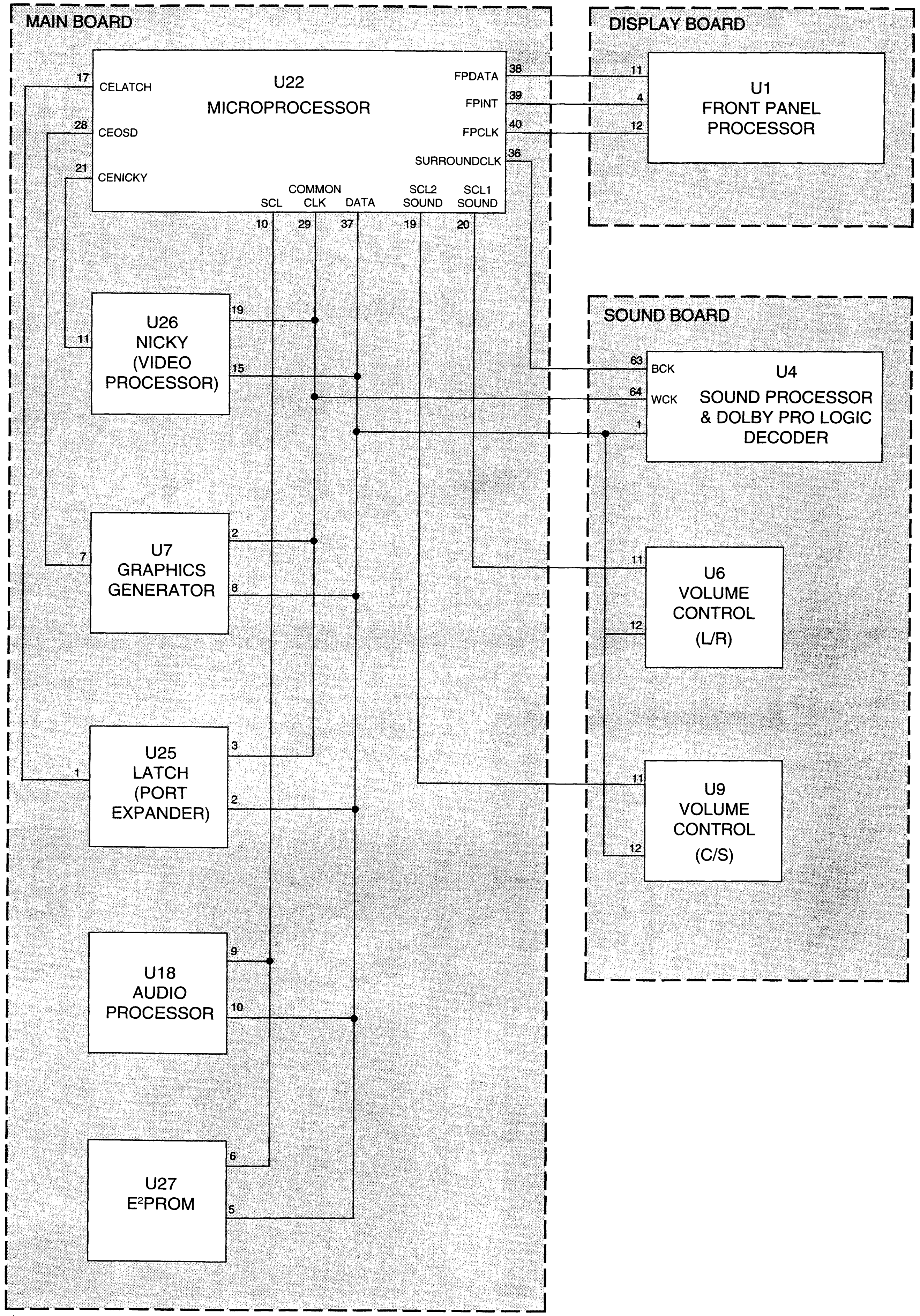

U1
Z8 ROMLESS
PL1
40 PIN HEADER
U3
74HC374
U4
EEPROM
C1
10UF
C2
100NF
C3
100NF
C4
100NF
C5
33PF
100V
10%
C6
39PF
100V
5%
X1
16MHZ FOR M881000
4MHZ OTHERWISE
FOR IR050 ONLY
CUT TRACK
CUT TRACK
PL2
TEST SOCKET
RESET
P34
N/C
AS
N/C
GND
P32
U1.49
U1.16
U1.21
J1
J2
J3
J4
VCC
MOD-WIRE
FOR IR050 ONLY

EEPROM		FITTED		N/F	
16K	256K	J2	J4	J1	J3
32K	256K	J1	J4	J2	J3
64K	512K	J1	J3	J2	J4

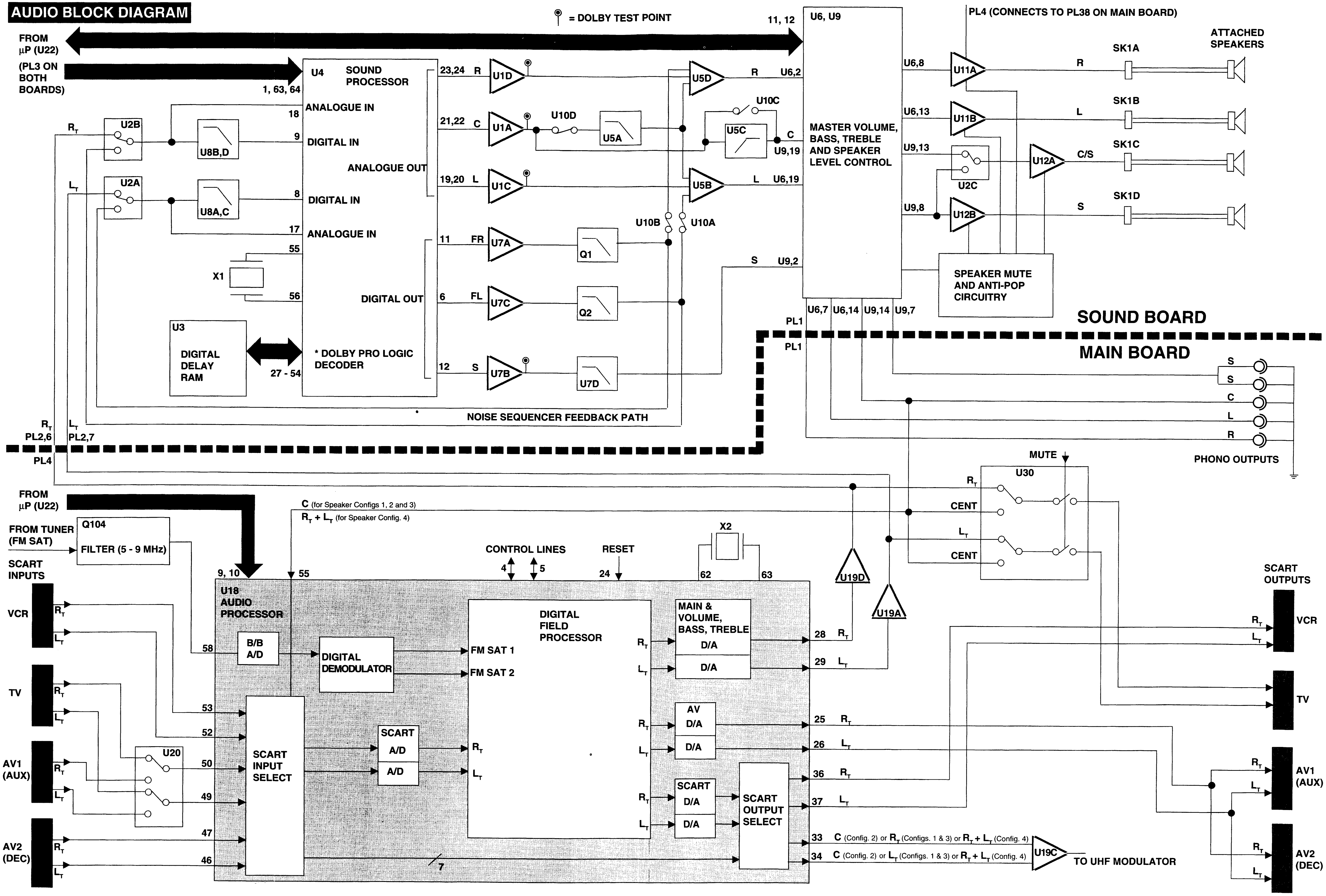

PL1
40
1
PL2
C2
182-0264101
C6
C5
C4
X1
U1
J1
J2
C1
U4
C3
U3



BLOCK DIAGRAM OF CLOCK AND DATA CONTROL LINES


MAIN BOARD
U22
MICROPROCESSOR
17
CELATCH
28
CEOSD
21
CENICKY
FPDATA
38
FPINT
39
FPCLK
40
SURROUNDCLK
36
SCL
COMMON
CLK
DATA
SCL2
SOUND
SCL1
SOUND
10
29
37
19
20
DISPLAY BOARD
U1
FRONT PANEL
PROCESSOR
11
4
12
U26
NICKY
(VIDEO
PROCESSOR)
19
15
11
U7
GRAPHICS
GENERATOR
2
8
7
U25
LATCH
(PORT
EXPANDER)
3
2
1
U18
AUDIO
PROCESSOR
9
10
U27
E²PROM
6
5
SOUND BOARD
U4
SOUND PROCESSOR
& DOLBY PRO LOGIC
DECODER
63
BCK
64
WCK
1
U6
VOLUME
CONTROL
(L/R)
11
12
U9
VOLUME
CONTROL
(C/S)
11
12

AUDIO BLOCK DIAGRAM


= DOLBY TEST POINT
FROM µP (U22)
(PL3 ON BOTH BOARDS)
11, 12
U6, U9
PL4 (CONNECTS TO PL38 ON MAIN BOARD)
ATTACHED SPEAKERS
U4 SOUND PROCESSOR
1, 63, 64
ANALOGUE IN
DIGITAL IN
ANALOGUE OUT
DIGITAL OUT
* DOLBY PRO LOGIC DECODER
18
9
8
17
55
56
27 - 54
X1
U3 DIGITAL DELAY RAM
U2B
U2A
U8B,D
U8A,C
23,24 R
21,22 C
19,20 L
11 FR
6 FL
12 S
U1D
U1A
U1C
U7A
U7C
U7B
U10D
U5A
Q1
Q2
U7D
U5D
U5C
U10C
U5B
U10B
U10A
R U6,2
C U9,19
L U6,19
S U9,2
MASTER VOLUME, BASS, TREBLE AND SPEAKER LEVEL CONTROL
U6,8
U6,13
U9,13
U9,8
U11A
U11B
U12A
U12B
U2C
SK1A
SK1B
SK1C
SK1D
R
L
C/S
S
SPEAKER MUTE AND ANTI-POP CIRCUITRY
U6,7
U6,14
U9,14
U9,7
PL1
SOUND BOARD
MAIN BOARD
NOISE SEQUENCER FEEDBACK PATH
R_T
L_T
PL2,6
PL2,7
PL4
S
S
C
L
R
PHONO OUTPUTS
MUTE
U30
R_T
CENT
L_T
CENT
FROM µP (U22)
FROM TUNER (FM SAT)
Q104
FILTER (5 - 9 MHz)
SCART INPUTS
C (for Speaker Configs 1, 2 and 3)
R_T + L_T (for Speaker Config. 4)
CONTROL LINES
RESET
X2
9, 10
55
4
5
24
62
63
U19D
U19A
SCART OUTPUTS
VCR
TV
AV1 (AUX)
AV2 (DEC)
U18 AUDIO PROCESSOR
B/B A/D
DIGITAL DEMODULATOR
DIGITAL FIELD PROCESSOR
FM SAT 1
FM SAT 2
MAIN & VOLUME, BASS, TREBLE
D/A
D/A
AV
D/A
D/A
SCART A/D
A/D
A/D
SCART D/A
D/A
D/A
SCART INPUT SELECT
SCART OUTPUT SELECT
U20
58
53
52
50
49
47
46
7
28 R_T
29 L_T
25 R_T
26 L_T
36 R_T
37 L_T
33 C (Config. 2) or R_T (Configs. 1 & 3) or R_T + L_T (Config. 4)
34 C (Config. 2) or L_T (Configs. 1 & 3) or R_T + L_T (Config. 4)
U19C
TO UHF MODULATOR
VCR
TV
AV1 (AUX)
AV2 (DEC)

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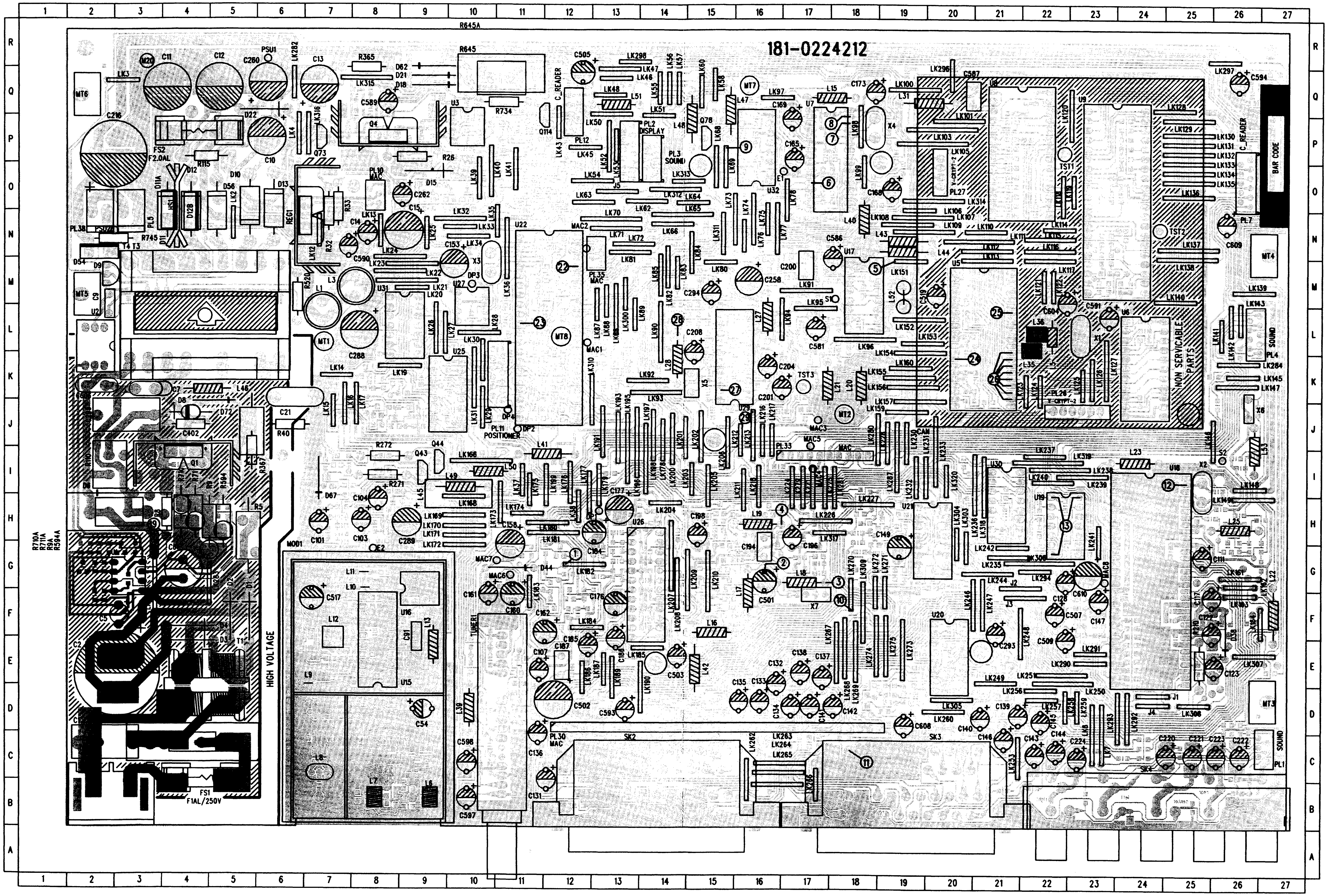
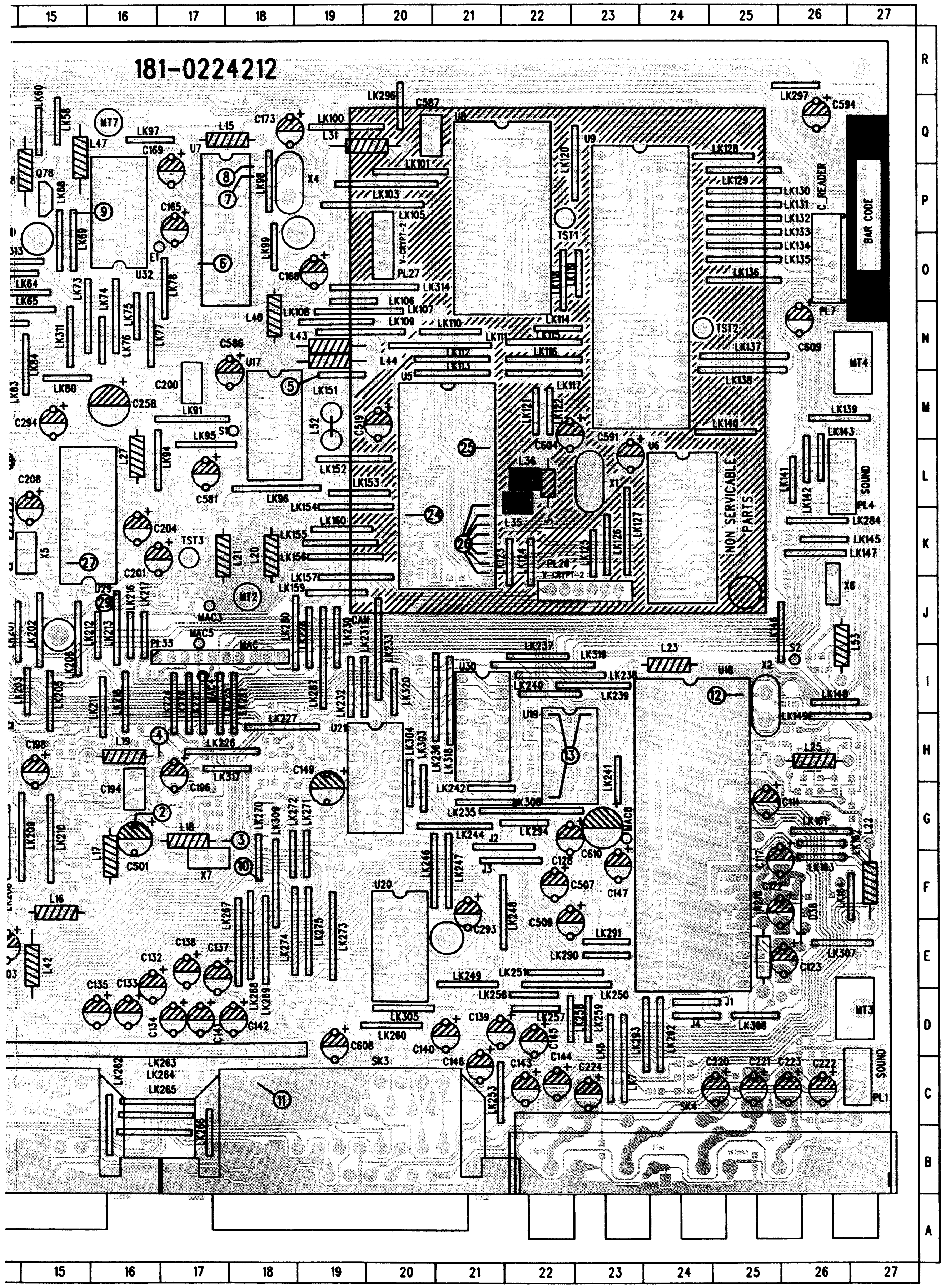
MAIN BOARD IDENT DIAGRAM - COMPONENT SIDE


181-0224212
HIGH VOLTAGE
NON SERVICABLE PARTS
BAR CODE
C_READER
SOUND
TUNER1
PL2 DISPLAY
PL3 SOUND
PL11 POSITIONER
PL30 MAC
SK2
SK3
SK4
FS1 F1AL/250V
FS2 F2.0AL
MOD1
PSU1
R645A
R710A
R711A
R94
R594A
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
R Q P O N M L K J I H G F E D C B A



GRID REFS FOR SOUND BOARD IDENT DIAGRAMS

SEE PAGES 54 & 55 FOR IDENT DIAGRAMS (FOLD THIS PAGE OVER TO SEE REFS AND DIAGRAMS SIMULTANEOUSLY)

* = not fitted

† = component on copper (SMD) side of PCB

CAPACITORS

C1	I2
C2	H8
C3	F2†
C4	F2†
C5	G2†
C6	G2
C7	H5†
C8	H5†
C9	G4†
C10	H4†
C11	H5†
C12	I5†
C13	I4†
C14	I5†
C15	I5†
C16	I4†
C17	G15
C18	H6
C19	I7
C20	F7†
C21	E6†
C22	E7†
C23	G7†
C24	G8†
C25	F8†
C26	H4
C27	I4
C28	G5†
C29	G4†
C30	G17†
C31	C7
C32	G10
C33	D11†
C34	G6†
C35	G6†
C36	G7†
C37	F5†
C38	G4†
C39	F5†
C40	G4†
C41	B7†
C42	C5
C43	D5
C44	C5†
C45	D5
C46	C7†
C47	D7
C48	D6†
C49	C10†
C50	D10†
C51	D7
C52	E10†
C53	E9†
C54	C7
C55	F10
C56	J2†
C57	C4†
C58	I7†
C59	D6†
C60	D9†
C61	H11
C62	G6†
C63	H4†
C64	H11†
C65	H11†
C66	E18
C67	E18
C68	E17
C69	E18†
C70	F18
C71	F18†
C72	G18
C73	C16†
C74	E16
C75	H17
C76	G8
C77	E15
C78	E14
C79	E13
C80	D13†
C81	H14
C82	D12†
C83	H13
C84	C12†
C85	E14
C86	E18
C87	G8†
C88	G6†
C89	G17†
C90	H7
C91	F17†
C92	G17
C93	E17
C94	F17†
C95	F16
C96	F15†
C97	G13
C98	G14†
C99	H15
C100	E14
C101	H14†
C102	F13†
C103	H15
C104	G11
C105	F14†
C106	F13
C109	F11†
C110	G13†
C111	J8
C112	I8†
C120	G4†
C121	F3†
C122	F16†
C123	F13†
C124	E10†
C125	C9†
C126	C10†
C127	C9†
C128	K8†
C129	C2

DIODES

D1	D18†
D2	C18†
D3	G4†
D4	I3†
D5	I3†
D6	I6†
D7	I5†
D8	F3†
D9	H8†
D10	G11†

INDUCTORS

LK1	J7
LK2	F5
LK3	D4
LK4	D2
LK5	G15
LK6	G12
LK7	G12
LK8	G12
LK9	E12
LK10	E12
LK11	D6
LK12	D9
LK13	F7
LK14	F5
LK15	F5
LK16	E6
LK17	F6
LK18	G6
LK19	H7
LK20	H6
LK21	J6
LK22	B4
LK23	E2
LK24	G4
LK25	G4
LK26	G4
LK27	G5
LK28	D6
LK29	E7
LK30	E7
LK31	D7
LK32	D6
LK33	C7
LK34	D7
LK35	D8
LK36	D9
LK37	D9
LK38	E7
LK39	D8
LK40	F9
LK41	F10
LK42	F10
LK43	F9
LK44	G8
LK45	G8
LK46	F9
LK47	F2†
LK49	E11
LK50	J7†
LK51	E12
LK52	F12
LK53	H3
LK54	E13
LK55	F14
LK56	F14
LK57	G15
LK58	G16
LK59	G16
LK64	H16
LK65	E16
LK66	F16
LK67	E17
LK68	F17
LK70	G12
LK71	H12
LK72	H12
LK73	G11
LK75	G10
LK76	G9
LK77	G9
LK78	H8
LK79	G5
LK80	G5
LK81	I6
LK82	I6
LK83	J5
LK84	J5
LK85	I2
LK86	D19
LK87	D19
LK88	G14
LK89	D11
LK90	D11
LK92	H19
LK93	D11
LK95	D4
LK96	H14†
LK97	H11†
LK98	H13†
LK99	H15†
LK100	G12†
LK101	G15†
LK102	G15†
LK103	G8†
LK104	G12†
LK105	F16
LK107	D14
LK108	D15
LK109	D16
LK110	E15
LK111	D11
LK112	E12
LK113	E19
LK114	E19
LK115	C12†
LK116	C13†
LK117	C15†
LK118	C8
LK119	B7
LK120	B5
LK121	J2†
LK122	G19
LK123	E9
LK124	D12

TRANSISTORS

Q1	G6†
Q2	G7†
Q3	D19†
Q4	C19†
Q5	F7†
Q6	C19†
Q7	E11†
Q8	E11†
Q9	F15†
Q10	F16†
Q11	H2†
Q12	B18†
Q13	K2†

RESISTORS

R1	B7†
R2	F2†
R3	G2†
R4	G3†
R5	H5†
R6	H5†
R7	H7†
R8	H4†
R9	H5†
R10	I4†
R11	J4†
R12	I6†
R13	I5†
R14	I5†
R15	D19†
R16	C19†
R17	D19†
R18	D18†
R19	F6†
R20	E6†
R21	E6†
R22	E6†
R23	G7†
R24	F8†
R25	F7†
R26	G7†
R27	G7†
R28	G6†
R29	G6†
R30	G6†
R31	B6†
R32	B5†
R33	C5†
R34	C6†
R35	C7†
R36	E9†
R37	F5†
R38	E10†
R39	E9†
R40	E9†
R41	C9†
R42	C9†
R43	C8†
R44	D8†
R45	D8†
R46	D9†
R47	D11†
R48	D10†
R49	D9†
R50	D15†
R51	E11†
R52	C18†
R53	E9†
R54	E9†
R55	H3†
R56	G3†
R57	I3†
R58	I3†
R59	G7†
R60	G7†
R61	G10†
R62	G10†
R63	H6†
R64	H6†
R65	J6†
R66	J6†
R73	F9†
R78	E18†
R79	F18†
R82	G2†
R83	F9†
R84	D13†
R85	D12†
R86	B9†
R87	B9†
R88	C9†
R89	F10†
R90	B10†
R91	B18†
R92	B18†
R93	C9†
R94	C9†
R95	B9†
R96	I2†
R97	J2†
R105	F8†
R106	E7†
R107	E11†
R108	F15†
R109	G18†

CONNECTORS

PL1	H18
SK1	D20
PL2	H10
PL3	J3
PL4	F15
PL5	K8
PL6	H18
PL7	J3
PL8	H10
PL9	E19
PL10	G20

ICS

U1	C6
U2	F11
U3	C3†
U4	E4†
U5	D10
U6	G17†
U7	F6
U8	H4
U9	G14†
U10	E8
U11	D17
U12	D13
U13	B9†

MISC. COMPONENTS

HS1	C13
J1	H16
J10	H8†
J11	H9†
J12	J2†
J13	E13
J2	H17
J3	H15
J4	G15
J5	G10
J6	G10
J7	B7†
J8	C7†
J9	G9†
WL1	D13
WL2	E5
WL3	D15
WL4	G14
WL5	G17
X1	F2

CARD READER BOARD IDENT DIAGRAMS AND ASSOCIATED GRID REFS

* = not fitted
† = component on copper (SMD) side of PCB

CAPACITORS

C1	C9†
C2	C9†
C3	D10†
C4	C16†
C5	F19
C6	C4†
C7	D3†
C8	F18
C9	F17
C10	D8†
C11	C21†
C12	D20†
C13	D10†
C14	F15†
C15	D3†

DIODES

D1	C8†
D2	C10†
D3	C8†
D4	C10†
D5	D14†
D6	C16†
D7	D14†
D8	C15†

INDUCTORS

LK1	C16†
LK2	C16†
LK3	C16†
LK4	C16†
LK5	D16†
LK6	D16†
LK7	D16†
LK8	C15†
LK9	C14†
LK10	D8†
LK11	F13†
LK12	D15†
LK14	C14†
LK15	F13†
LK16	C5†
LK17	C8†
LK18	C9†
LK19	C9†
LK20	D15†
LK21	C8†
LK22	D8†
LK23	D9†
LK24	D9†
LK25	C9†
LK26	C9†
LK27	C10†
LK28	D10†
LK29	D10†
LK30	C10†
LK31	C8†
LK32	C10†
LK33	C13†
LK34	C8†
LK35	D9†
LK36	C14†
LK37	C14†
LK38	C15†
LK39	D14†
LK40	D14†
LK41	D14†
LK42	D9†
LK43	D14†
LK44	C14†
LK45	C14†
LK46	C14†
LK47	D16†
LK49	C14†
LK50	C14†
LK51	C14†
LK52	D20†
LK53	C3
LK54	D4
LK55	D4
LK56	D4
LK57	D4
LK58	C4
LK59	C4
LK60	C5
LK61	D6
LK62	E9
LK63	E11
LK64	E12
LK65	E13
LK66	D19
LK67	D19
LK68	D19
LK69	C19
LK70	C19
LK71	C19
LK72	C19
LK74	F4
LK75	D19
LK76	C4
LK77	D4†
LK78	E11†
LK79	D13†

TRANSISTORS

Q1	D20†
Q2	D6†
Q3	C20
Q4	C5
Q5	C21†
Q6	D21
Q7	D5†
Q8	C4
Q9	D5†

RESISTORS

R1	C8†
R2	C8†
R3	C10†
R4	D10†
R5	C15†
R6	C5†
R7	C20†
R8	C20†
R9	C20†
R10	D21†
R11	D21†
R12	D5†
R13	D5†
R14	D5†
R15	C4†
R16	C16†
R17	C4†
R18	D4†
R19	D10†
R20	D20†
R21	D8†
R22	D8†
R23	D9†
R24	D9†
R25	D8†
R26	D9†
R27	F14†
R28	F14†
R29	F15†
R30	F15†
R31	F14†
R32	F15†
R33	D14†
R34	D16†
R35	D16†
R36	D20†
R37	C20†
R38	C6†
R39	D5†
R40	F20
R41	D16†
R42	D13†
R43	D5†
R44	E6

CONNECTORS

PL1	E4
PL2	E21

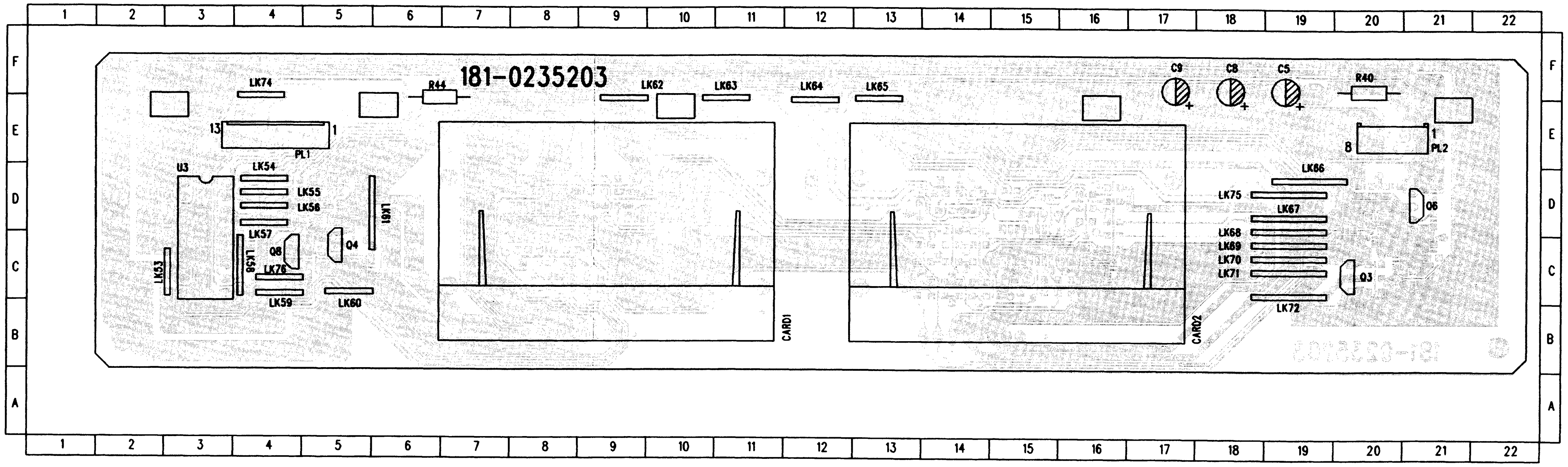
ICS

U1	D10†
U2	C15†
U3	C3
U4	D8†

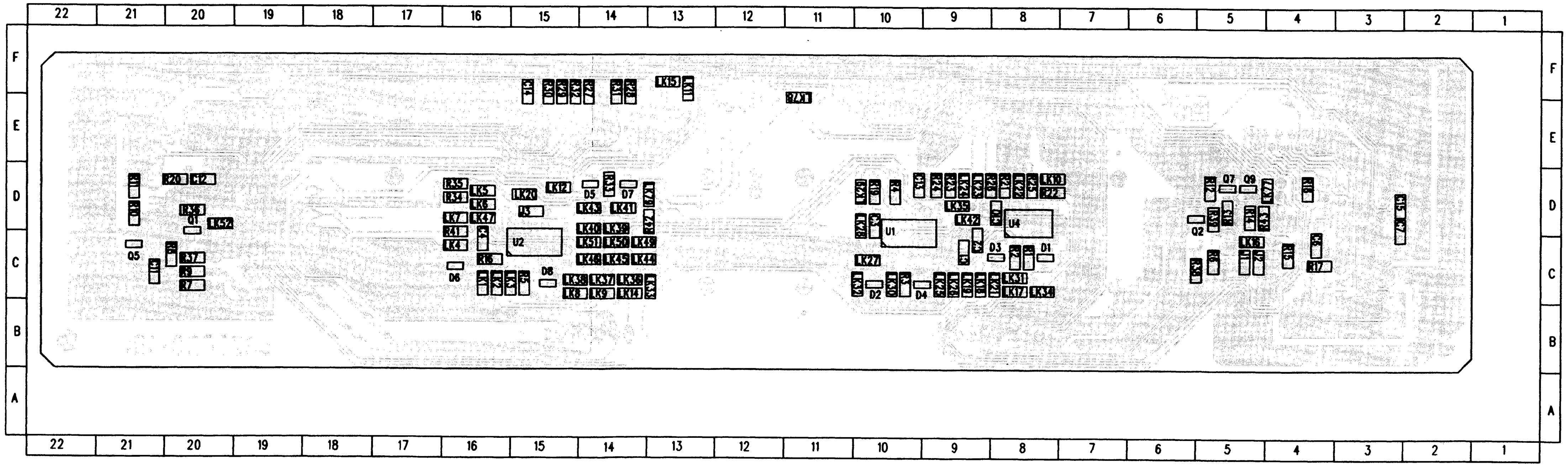
MISC. COMPONENTS

CARD1	D9
CARD2	D15
J1	C5†
J2	C5†
J3	D15†

SURFACE MOUNT SIDE OF PCB

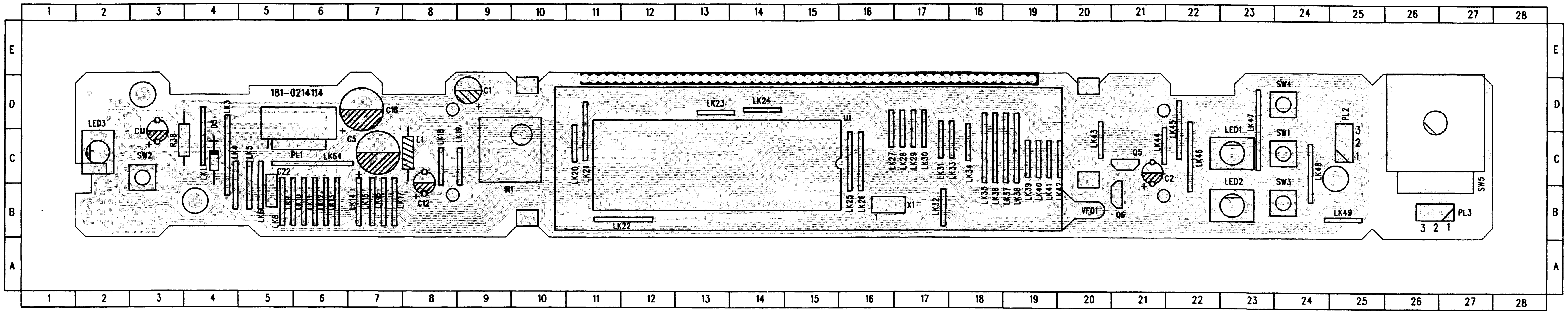

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
F E D C B A
181-0235203
LK74
R44
LK62
LK63
LK64
LK65
C9
C8
C5
R40
PL1
PL2
U3
LK54
LK55
LK56
LK57
LK58
LK53
LK61
Q8
Q4
LK76
LK59
LK60
CARD1
CARD2
LK66
LK75
LK67
LK68
LK69
LK70
LK71
LK72
Q6
Q3

COMPONENT IDENT SIDE OF PCB

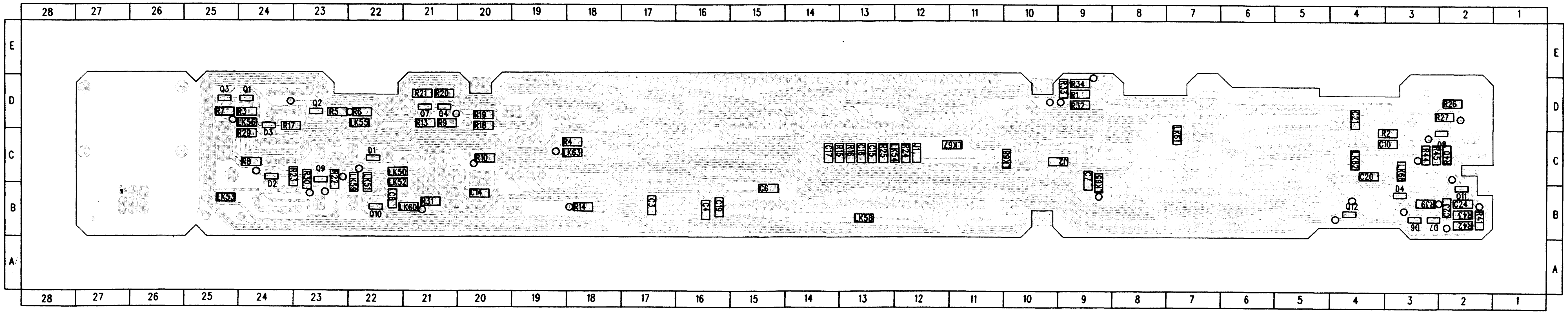

22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1
F E D C B A
U1
U2
U4
Q1
Q2
Q5
Q7
Q9
D1
D2
D3
D4
D5
D6
D7
D8

DISPLAY BOARD IDENT DIAGRAMS

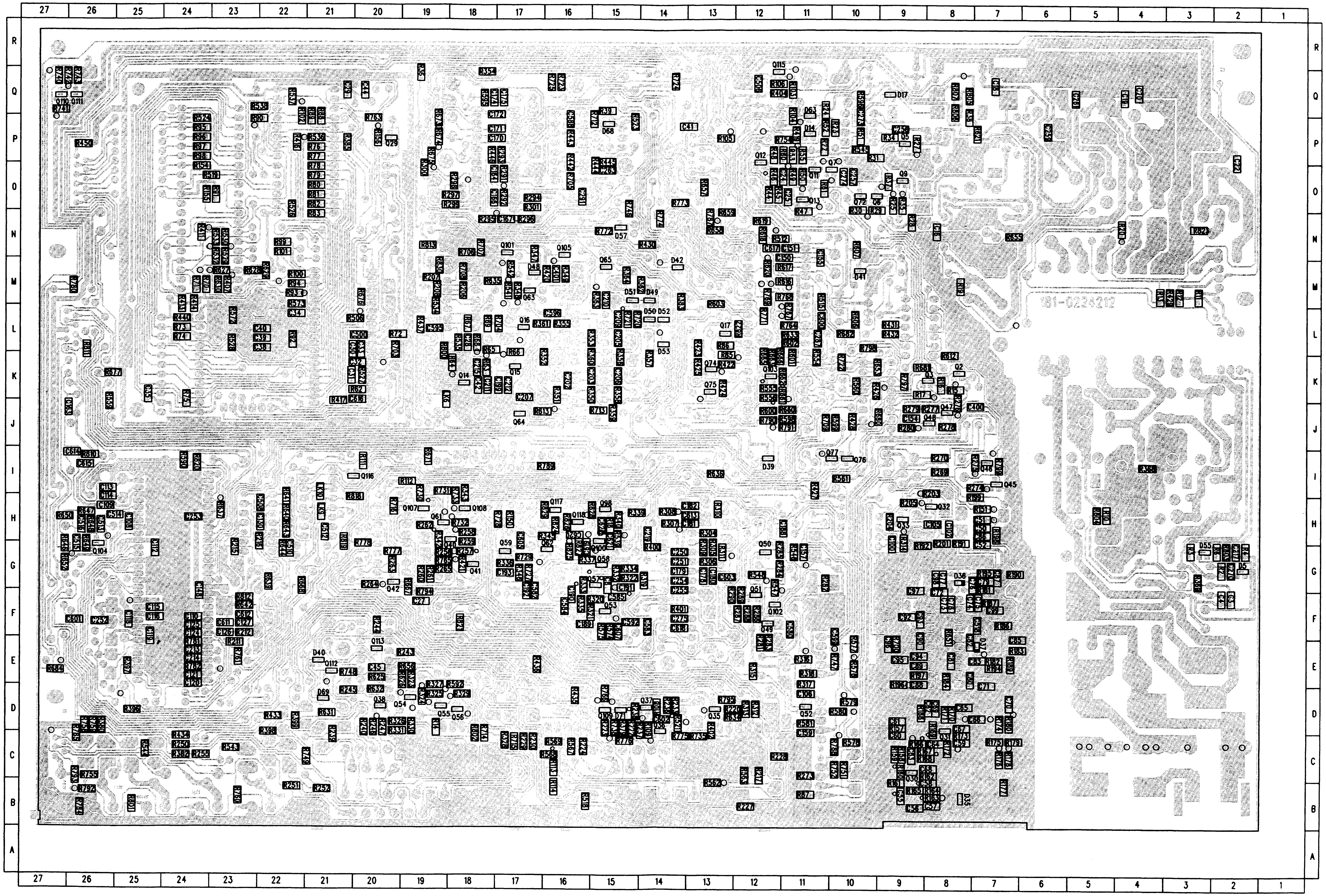
SURFACE MOUNT SIDE OF PCB

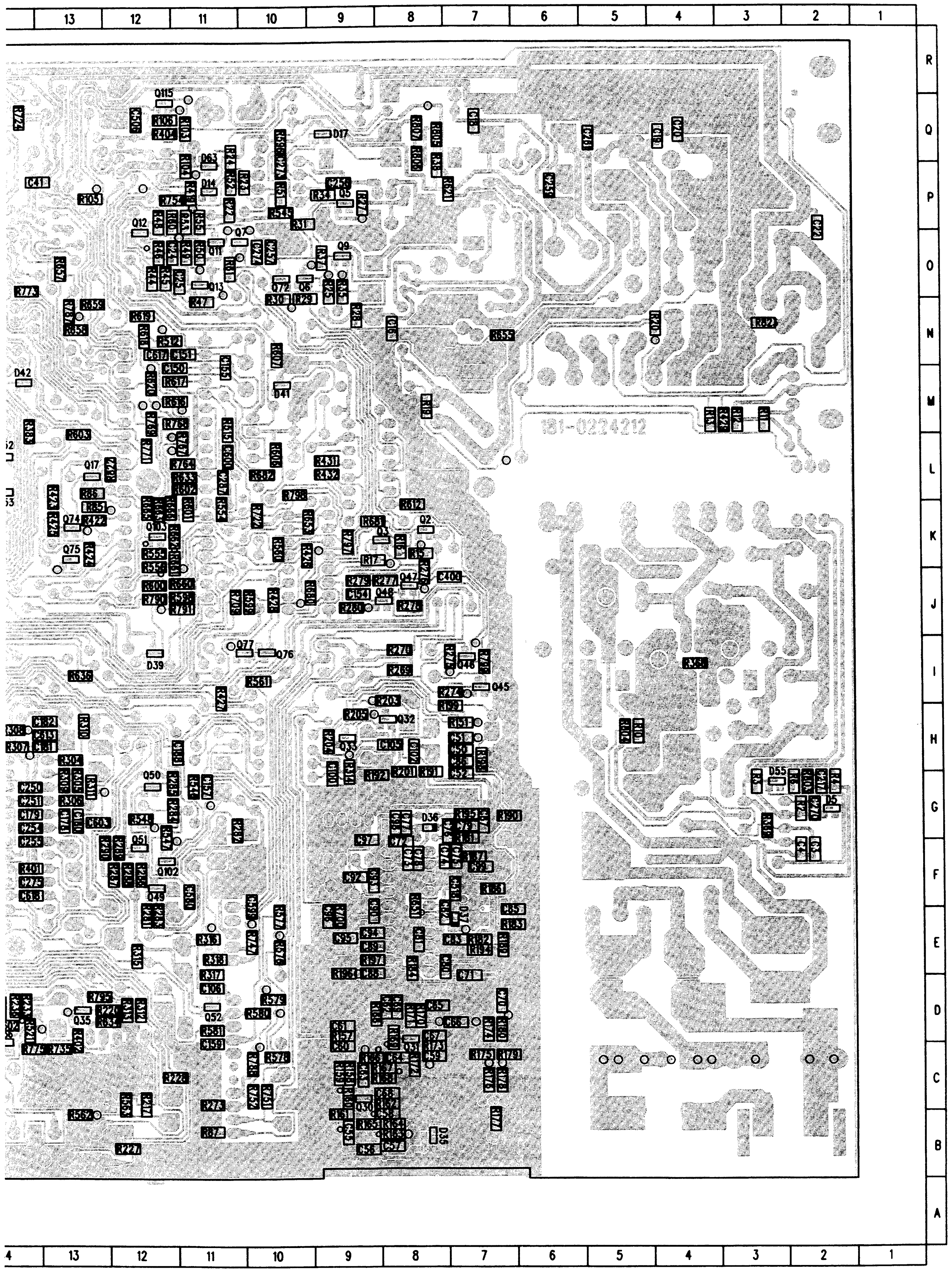

181-0214114
LED3
C11
SW2
R38
D5
LK1
LK3
LK4
LK5
LK6
LK8
C22
PL1
LK64
C5
C18
L1
LK18
LK19
LK14
LK15
LK16
LK17
C12
C1
IR1
LK20
LK21
LK22
LK23
LK24
U1
LK25
LK26
X1
LK27
LK28
LK29
LK30
LK31
LK33
LK34
LK32
LK35
LK36
LK37
LK38
LK39
LK40
LK41
LK42
LK43
VFD1
Q5
Q6
C2
LK44
LK45
LK46
LK47
LED1
LED2
SW4
SW1
SW3
LK48
LK49
PL2
PL3
SW5
3 2 1

COMPONENT IDENT SIDE OF PCB


Q3
Q1
Q2
R7
R3
R5
R6
LK56
LK55
R29
D3
R17
R21
R20
Q7
Q4
R13
R9
R19
R18
R4
LK63
R8
D1
R10
Q9
D2
LK53
Q10
LK50
LK52
LK60
R31
C14
R14
C6
LK58
LK62
R34
R1
R32
LK61
C20
R26
R27
R2
C10
D4
Q11
Q12
R39
C24
R42
D6
D7

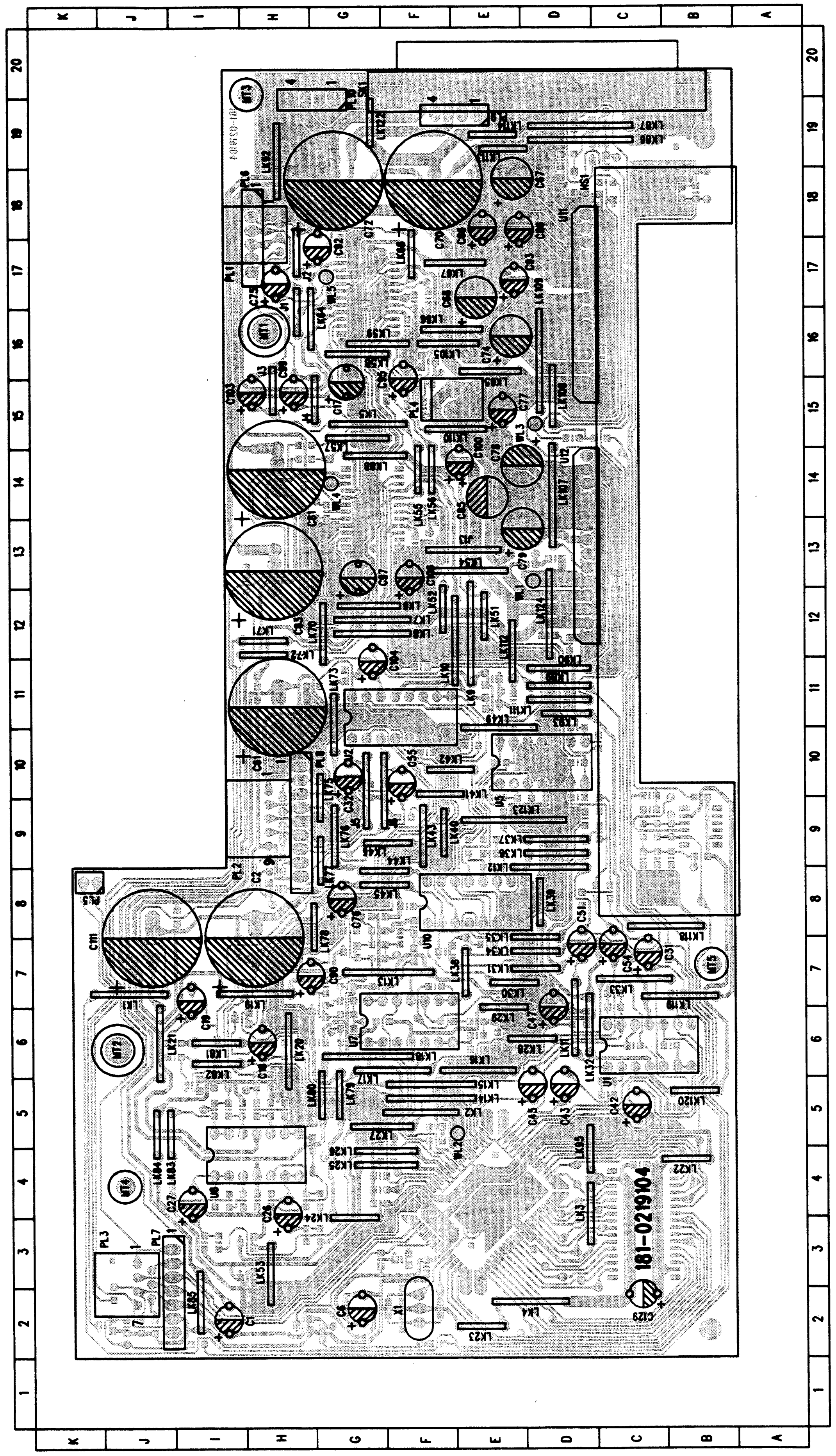
MAIN BOARD IDENT DIAGRAM - SURFACE MOUNT SIDE


27
26
25
24
23
22
21
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
R
Q
P
O
N
M
L
K
J
I
H
G
F
E
D
C
B
A

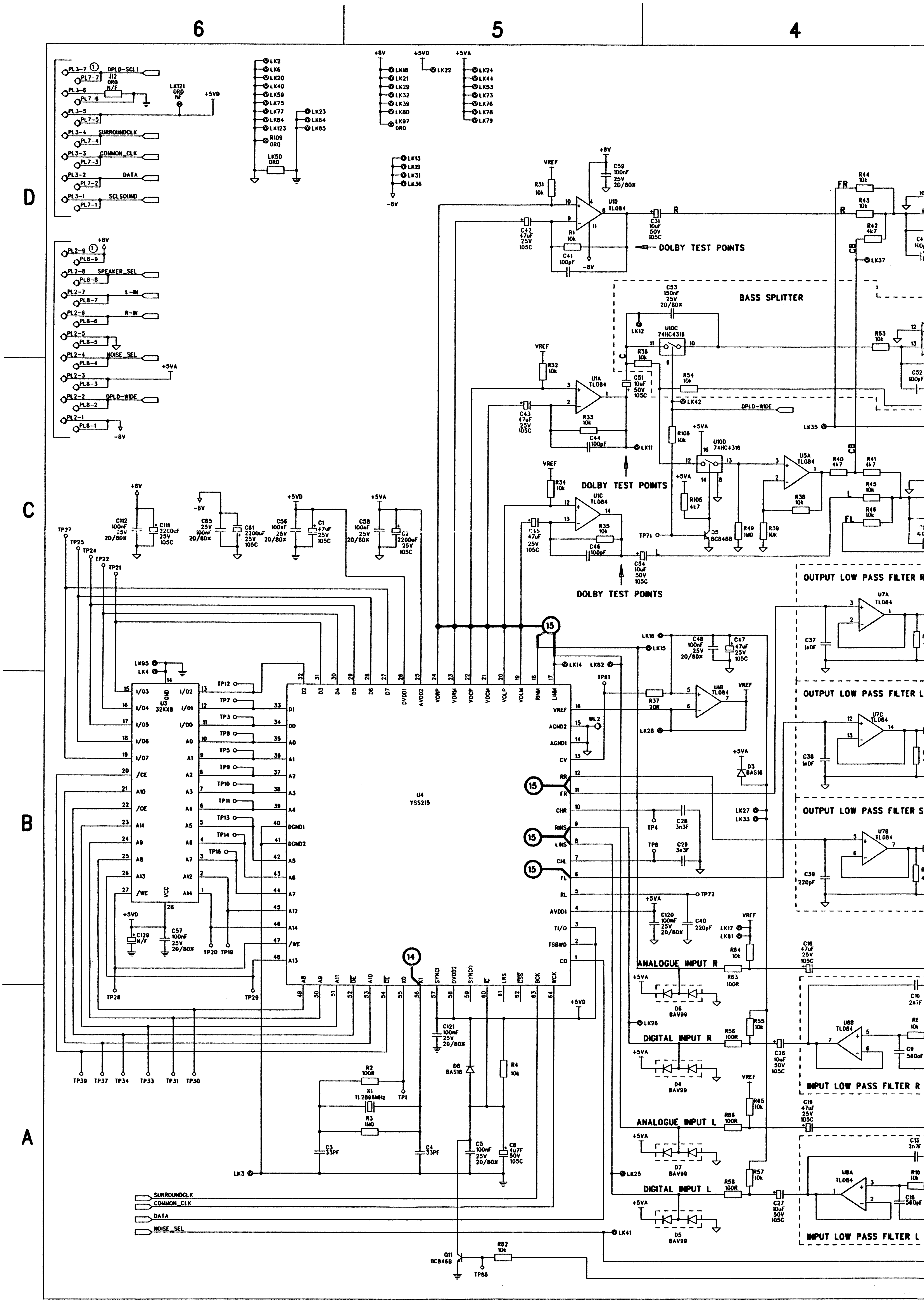

13
12
11
10
9
8
7
6
5
4
3
2
1
R
Q
P
O
N
M
L
K
J
I
H
G
F
E
D
C
B
A
181-0224212

SOUND BOARD IDENT DIAGRAMS

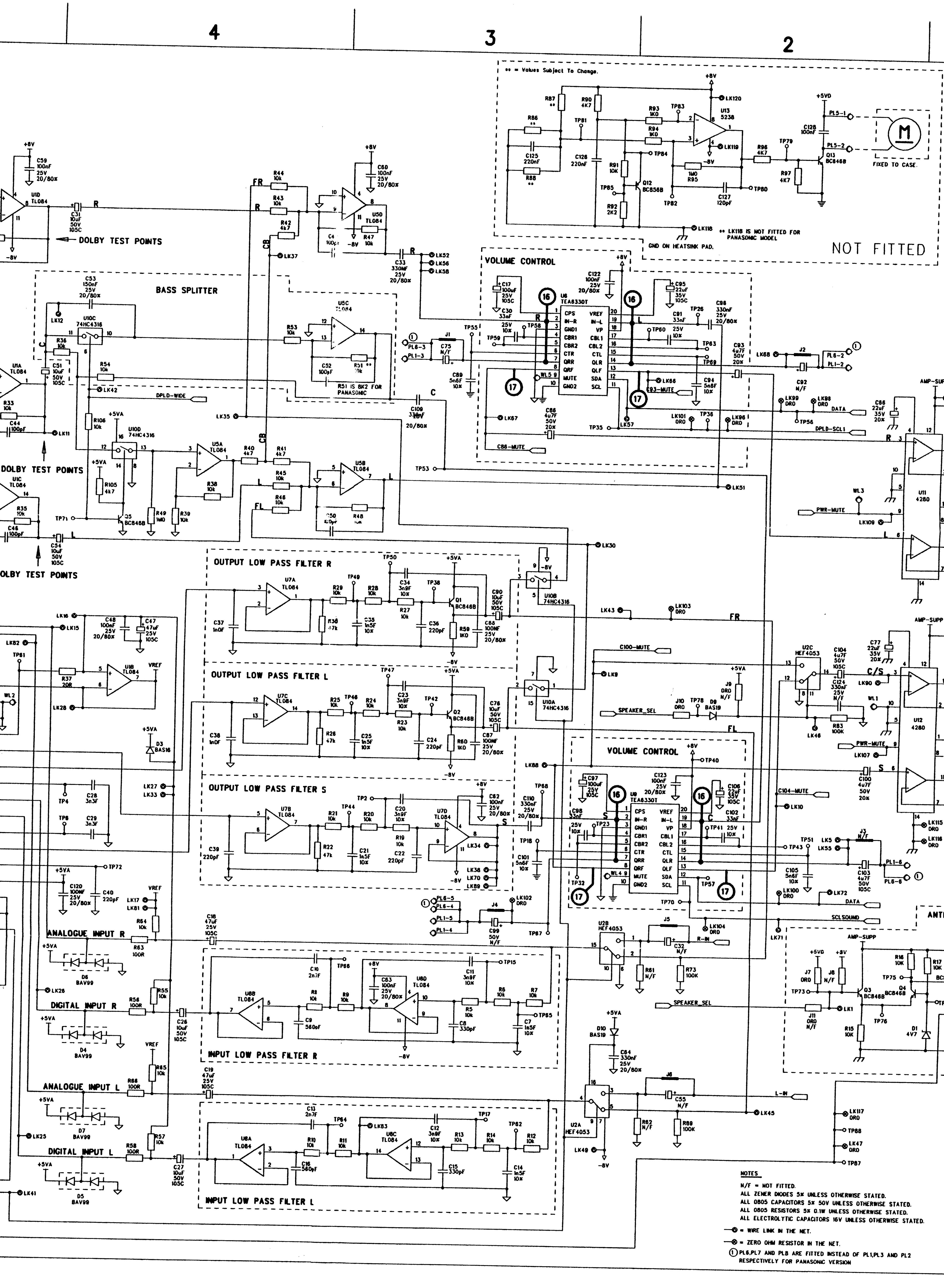
SURFACE MOUNT SIDE OF PCB


K
J
I
H
G
F
E
D
C
B
A
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
181-0219104

CIRCUIT DIAGRAM OF SOUND BOARD

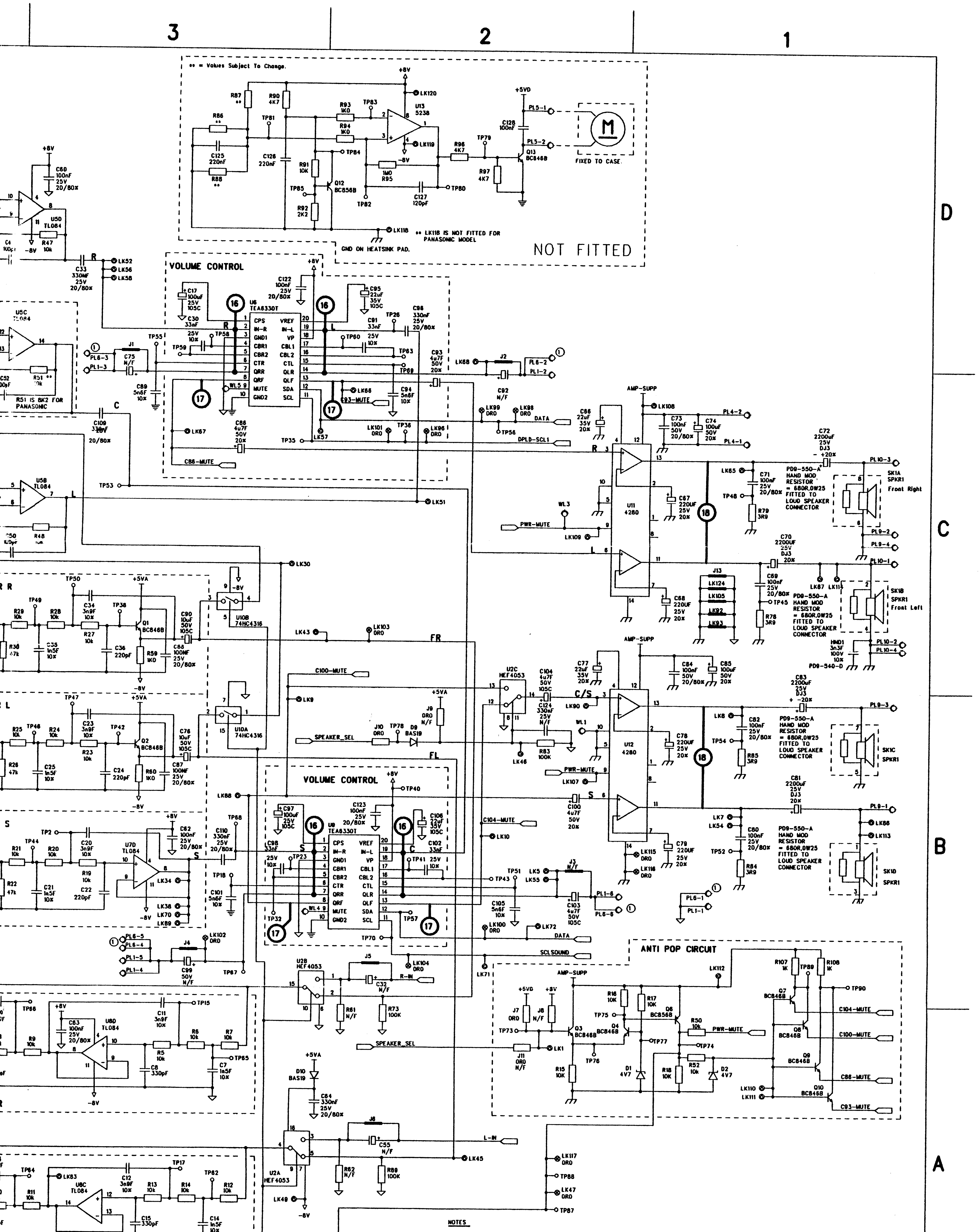


6
5
4
D
C
B
A
PL3-7
PL7-7
DPLD-SCL1
J12
0R0
N/F
PL3-6
PL7-6
LK121
0R0
NF
+5VD
PL3-5
PL7-5
PL3-4
PL7-4
SURROUNDCLK
PL3-3
PL7-3
COMMON_CLK
PL3-2
PL7-2
DATA
PL3-1
PL7-1
SCLSOUND
PL2-9
PL8-9
+8V
PL2-8
PL8-8
SPEAKER_SEL
PL2-7
PL8-7
L-IN
PL2-6
PL8-6
R-IN
PL2-5
PL8-5
PL2-4
PL8-4
NOISE_SEL
+5VA
PL2-3
PL8-3
PL2-2
PL8-2
DPLD-WIDE
PL2-1
PL8-1
-8V
LK2
LK6
LK20
LK40
LK59
LK75
LK77
LK84
LK123
R109
0R0
LK50
0R0
LK23
LK64
LK85
+8V
LK18
LK21
LK29
LK32
LK39
LK80
LK97
0R0
+5VD
LK22
+5VA
LK24
LK44
LK53
LK73
LK76
LK78
LK79
LK13
LK19
LK31
LK36
-8V
VREF
R31
10k
+8V
C59
100nF
25V
20/80%
U1D
TL084
C42
47uF
25V
105C
R1
10k
C41
100pF
-8V
C31
10uF
50V
105C
R
DOLBY TEST POINTS
FR
R44
10k
R43
10k
R42
4k7
CB
LK37
C53
150nF
25V
20/80%
BASS SPLITTER
LK12
U10C
74HC4316
R36
10k
C
C51
10uF
50V
105C
R54
10k
LK42
DPLD-WIDE
VREF
R32
10k
U1A
TL084
C43
47uF
25V
105C
R33
10k
C44
100pF
LK11
R53
10k
C52
100pF
LK35
R106
10k
+5VA
U10D
74HC4316
+5VA
R105
4k7
U5A
TL084
R40
4k7
R41
4k7
CB
R38
10k
R45
10k
L
R46
10k
FL
DOLBY TEST POINTS
VREF
R34
10k
U1C
TL084
C45
47uF
25V
105C
R35
10k
C46
100pF
TP71
Q5
BC846B
R49
1M0
R39
10k
C54
10uF
50V
105C
L
DOLBY TEST POINTS
+8V
C112
100nF
25V
20/80%
C111
2200uF
25V
105C
-8V
C85
25V
100nF
20/80%
C61
2200uF
25V
105C
+5VD
C56
100nF
25V
20/80%
C1
47uF
25V
105C
+5VA
C58
100nF
25V
20/80%
C2
2200uF
25V
105C
TP27
TP25
TP24
TP22
TP21
OUTPUT LOW PASS FILTER R
U7A
TL084
C37
1n0F
15
LK16
LK15
C48
100nF
25V
20/80%
C47
47uF
25V
105C
LK95
LK4
LK14
LK82
TP61
U1B
TL084
VREF
R37
20R
LK28
OUTPUT LOW PASS FILTER L
U7C
TL084
C38
1n0F
+5VA
D3
BAS16
OUTPUT LOW PASS FILTER S
U7B
TL084
C39
220pF
LK27
LK33
TP4
C28
3n3F
TP6
C29
3n3F
TP72
+5VA
C120
100nF
25V
20/80%
C40
220pF
VREF
LK17
LK81
R64
10k
C18
47uF
25V
105C
ANALOGUE INPUT R
R63
100R
+5VA
D6
BAV99
C10
2n7F
U8B
TL084
R8
10k
C9
560pF
INPUT LOW PASS FILTER R
LK26
R55
10k
DIGITAL INPUT R
R56
100R
C26
10uF
50V
105C
+5VA
D4
BAV99
VREF
R65
10k
C19
47uF
25V
105C
ANALOGUE INPUT L
R66
100R
+5VA
D7
BAV99
C13
2n7F
U8A
TL084
R10
10k
C16
560pF
LK25
R57
10k
DIGITAL INPUT L
R58
100R
C27
10uF
50V
105C
+5VA
D5
BAV99
INPUT LOW PASS FILTER L
LK41
U3
32KX8
GND
I/O3
I/O2
I/O4
I/O1
I/O5
I/O0
I/O6
A0
I/O7
A1
/CE
A2
A10
A3
/OE
A4
A11
A5
A9
A6
A8
A7
A13
A12
/WE
VCC
A14
TP12
TP7
TP3
TP8
TP5
TP9
TP10
TP11
TP13
TP14
TP16
+5VD
C129
N/F
C57
100nF
25V
20/80%
TP20
TP19
TP28
TP29
U4
YSS215
D2
D3
D4
D5
D6
D7
DVDD1
AVDD2
VORP
VORM
VOCP
VOCM
VOLP
VOLM
RINM
LINM
VREF
AGND2
AGND1
CV
RR
FR
CHR
RINS
LINS
CHL
FL
RL
AVDD1
TI/O
TSBWD
CD
D1
D0
A0
A1
A2
A3
A4
DGND1
DGND2
A5
A6
A7
A12
A14
/WE
A13
A8
A9
A11
OE
A10
CE
X0
X1
SYNCI
DVDD2
SYNCO
IC
LRS
CSS
BCK
WCK
WL2
14
+5VD
C121
100NF
25V
20/80%
R2
100R
X1
11.2896MHz
TP1
R3
1M0
C3
33PF
C4
33PF
D8
BAS16
R4
10k
C5
100nF
25V
20/80%
C6
4u7F
50V
105C
LK3
TP39
TP37
TP34
TP33
TP31
TP30
SURROUNDCLK
COMMON_CLK
DATA
NOISE_SEL
Q11
BC846B
R82
10k
TP86


4
3
2
** = Values Subject To Change.
U13 5238
Q12 BC856B
Q13 BC846B
** LK118 IS NOT FITTED FOR PANASONIC MODEL
GND ON HEATSINK PAD.
FIXED TO CASE.
NOT FITTED
VOLUME CONTROL
U6 TEA6330T
BASS SPLITTER
U10C 74HC4316
U5C TL084
R51 IS 8K2 FOR PANASONIC
U1D TL084
U5D TL084
DOLBY TEST POINTS
U1A TL084
U1C TL084
U10D 74HC4316
Q5 BC846B
U5A TL084
U5B TL084
DPLD-WIDE
C88-MUTE
C93-MUTE
DATA
DPLD-SCL1
PWR-MUTE
U11 4280
OUTPUT LOW PASS FILTER R
U7A TL084
Q1 BC846B
U10B 74HC4316
OUTPUT LOW PASS FILTER L
U7C TL084
Q2 BC846B
U10A 74HC4316
OUTPUT LOW PASS FILTER S
U7B TL084
U7D TL084
U1B TL084
C100-MUTE
SPEAKER_SEL
U2C HEF4053
U12 4280
C104-MUTE
VOLUME CONTROL
U9 TEA6330T
DATA
SCLSOUND
ANALOGUE INPUT R
DIGITAL INPUT R
ANALOGUE INPUT L
DIGITAL INPUT L
D6 BAV99
D4 BAV99
D7 BAV99
D5 BAV99
INPUT LOW PASS FILTER R
U8B TL084
U8D TL084
INPUT LOW PASS FILTER L
U8A TL084
U8C TL084
U2B HEF4053
U2A HEF4053
R-IN
L-IN
AMP-SUPP
Q3 BC846B
Q4 BC846B
D1 4V7
SPEAKER_SEL

NOTES

N/F = NOT FITTED.
ALL ZENER DIODES 5% UNLESS OTHERWISE STATED.
ALL 0805 CAPACITORS 5% 50V UNLESS OTHERWISE STATED.
ALL 0805 RESISTORS 5% 0.1W UNLESS OTHERWISE STATED.
ALL ELECTROLYTIC CAPACITORS 16V UNLESS OTHERWISE STATED.
—⊘ = WIRE LINK IN THE NET.
—⊗ = ZERO OHM RESISTOR IN THE NET.
① PL6,PL7 AND PL8 ARE FITTED INSTEAD OF PL1,PL3 AND PL2 RESPECTIVELY FOR PANASONIC VERSION


3
2
1
D
C
B
A
** = Values Subject To Change.
NOT FITTED
** LK118 IS NOT FITTED FOR PANASONIC MODEL
GND ON HEATSINK PAD.
FIXED TO CASE.
U13 5238
Q12 BC856B
Q13 BC846B
VOLUME CONTROL
U6 TEA6330T
U9 TEA6330T
CPS
IN-R
GND1
CBR1
CBR2
CTR
QRR
QRF
MUTE
GND2
VREF
IN-L
VP
CBL1
CBL2
CTL
QLR
QLF
SDA
SCL
U11 4280
U12 4280
R51 IS 8K2 FOR PANASONIC
PD9-550-A HAND MOD RESISTOR = 680R,0W25 FITTED TO LOUD SPEAKER CONNECTOR
SK1A SPKR1 Front Right
SK1B SPKR1 Front Left
SK1C SPKR1
SK1D SPKR1
PD9-540-D
U10B 74HC4316
U10A 74HC4316
U2C HEF4053
U2B HEF4053
U2A HEF4053
U5C TL084
U5B TL084
U5D TL084
U7D TL084
U8D TL084
U8C TL084
Q1 BC846B
Q2 BC846B
ANTI POP CIRCUIT
Q3 BC846B
Q4 BC846B
Q6 BC856B
Q7 BC846B
Q8 BC846B
Q9 BC846B
Q10 BC846B
D1 4V7
D2 4V7
D9 BAS19
D10 BAS19
AMP-SUPP
PWR-MUTE
C100-MUTE
C104-MUTE
C88-MUTE
C93-MUTE
SPEAKER_SEL
DATA
DPLD-SCL1
SCLSOUND
R-IN
L-IN
FR
FL
C/S
+8V
-8V
+5VA
+5VD

NOTES

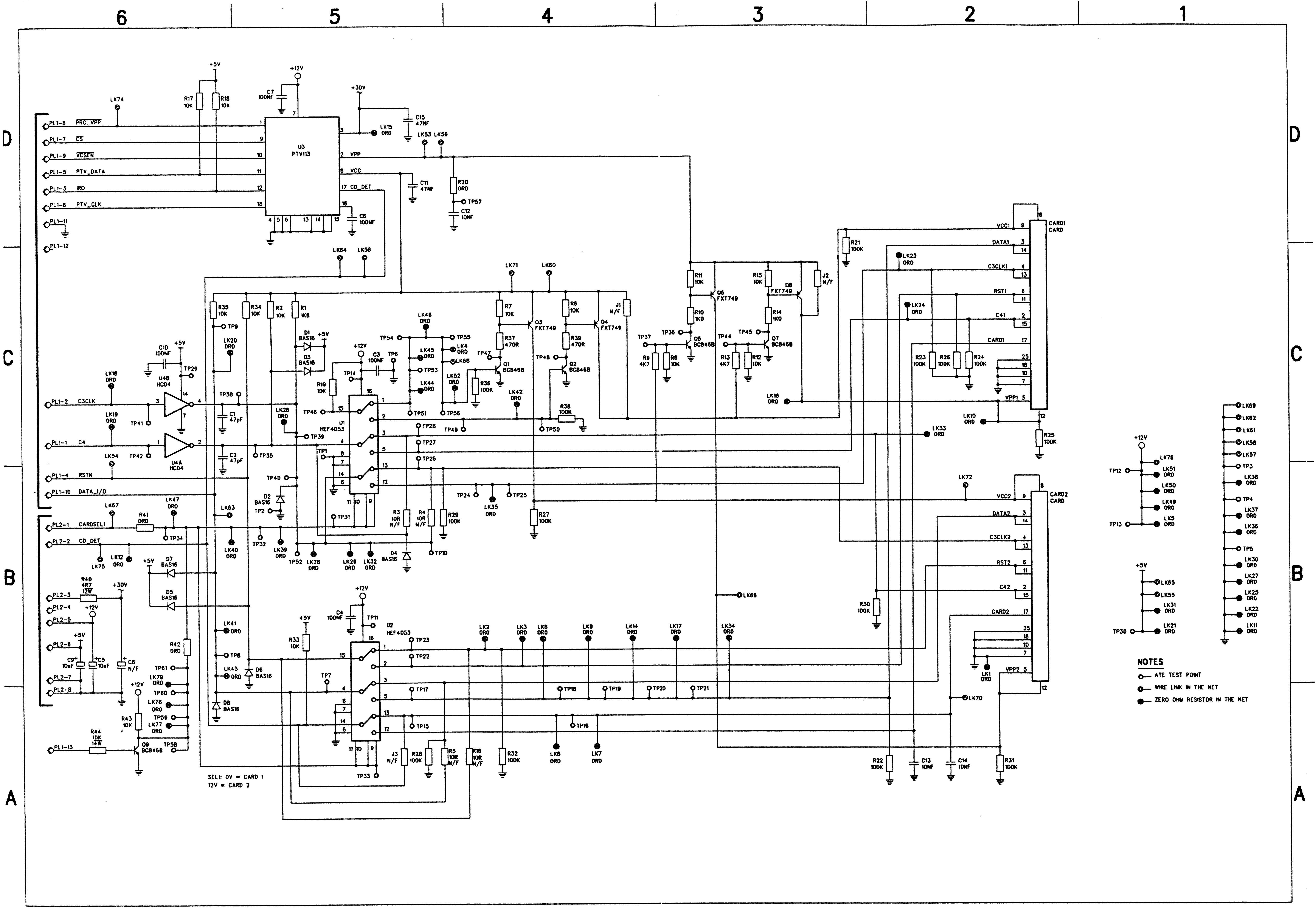
N/F = NOT FITTED.
ALL ZENER DIODES 5% UNLESS OTHERWISE STATED.
ALL 0805 CAPACITORS 5% 50V UNLESS OTHERWISE STATED.
ALL 0805 RESISTORS 5% 0.1W UNLESS OTHERWISE STATED.
ALL ELECTROLYTIC CAPACITORS 16V UNLESS OTHERWISE STATED.

—⊘ = WIRE LINK IN THE NET.

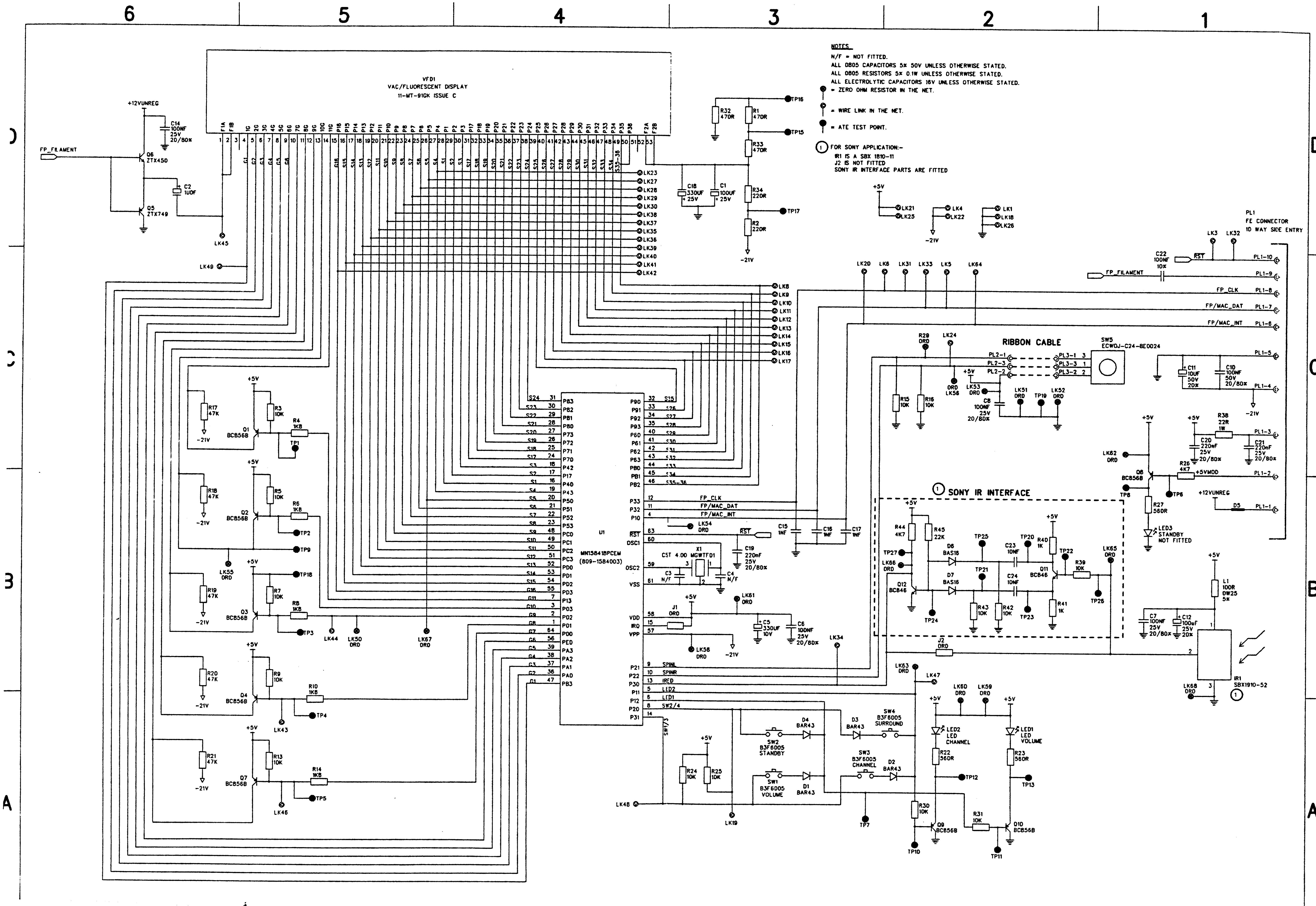
—⊗ = ZERO OHM RESISTOR IN THE NET.

① PL6,PL7 AND PL8 ARE FITTED INSTEAD OF PL1,PL3 AND PL2 RESPECTIVELY FOR PANASONIC VERSION

CIRCUIT DIAGRAM OF CARD READER BOARD


6
5
4
3
2
1
D
C
B
A
PL1-8 PRG_VPP
PL1-7 CS
PL1-9 VCSEN
PL1-5 PTV_DATA
PL1-3 IRQ
PL1-6 PTV_CLK
PL1-11
PL1-12
PL1-2 C3CLK
PL1-1 C4
PL1-4 RSTN
PL1-10 DATA_I/O
PL2-1 CARDSEL1
PL2-2 CD_DET
PL2-3
PL2-4
PL2-5
PL2-6
PL2-7
PL2-8
PL1-13
U3 PTV113
VPP
VCC
CD_DET
+5V
+12V
+30V
R17 10K
R18 10K
C7 100NF
LK74
LK15 0R0
C15 47NF
LK53
LK59
C11 47NF
R20 0R0
TP57
C12 10NF
C6 100NF
LK64
LK56
LK71
LK60
R35 10K
R34 10K
R2 10K
R1 1K8
TP9
LK20 0R0
C10 100NF
U4B HC04
U4A HC04
TP29
LK18 0R0
LK19 0R0
LK54
TP41
TP42
TP38
C1 47pF
C2 47pF
TP35
D1 BAS16
D3 BAS16
LK26 0R0
TP39
TP40
D2 BAS16
TP2
TP1
TP31
TP46
R19 10K
TP14
C3 100NF
TP6
U1 HEF4053
TP54
LK48 0R0
TP55
LK45 0R0
LK4 0R0
LK68
TP53
LK44 0R0
LK52 0R0
TP51
TP56
TP47
Q1 BC846B
R36 100K
LK42 0R0
R7 10K
R37 470R
Q3 FXT749
R6 10K
R39 470R
Q4 FXT749
TP48
Q2 BC846B
R38 100K
J1 N/F
TP28
TP27
TP26
TP49
TP50
TP24
LK35 0R0
TP25
R3 10R N/F
R4 10R N/F
R29 100K
D4 BAS16
TP10
R27 100K
LK67
R41 0R0
LK47 0R0
TP34
LK63
TP32
LK39 0R0
LK40 0R0
LK75
LK12 0R0
TP52
LK28 0R0
LK29 0R0
LK32 0R0
R40 4R7 1/2W
D7 BAS16
D5 BAS16
C9 10uF
C5 10uF
C8 N/F
R42 0R0
TP61
LK79 0R0
TP60
LK78 0R0
TP59
LK77 0R0
TP58
R43 10K
R44 10K 1/4W
Q9 BC846B
LK41 0R0
TP8
LK43 0R0
D6 BAS16
D8 BAS16
R33 10K
C4 100NF
TP11
U2 HEF4053
TP23
TP22
TP7
TP17
TP15
J3 N/F
R28 100K
R5 10R N/F
R16 10R N/F
R32 100K
TP33
SEL1: 0V = CARD 1
12V = CARD 2
LK2 0R0
LK3 0R0
LK8 0R0
LK9 0R0
LK14 0R0
LK17 0R0
LK34 0R0
TP18
TP19
TP20
TP21
TP16
LK6 0R0
LK7 0R0
R11 10K
Q6 FXT749
R10 1K0
TP37
TP36
Q5 BC846B
R9 4K7
R8 10K
R15 10K
Q8 FXT749
J2 N/F
R14 1K0
TP45
TP44
Q7 BC846B
R13 4K7
R12 10K
LK16 0R0
LK66
R21 100K
LK23 0R0
LK24 0R0
R23 100K
R26 100K
R24 100K
LK10 0R0
LK33 0R0
R25 100K
VCC1
DATA1
C3CLK1
RST1
C41
CARD1
VPP1
CARD1 CARD
LK72
VCC2
DATA2
C3CLK2
RST2
C42
CARD2
VPP2
CARD2 CARD
R30 100K
LK1 0R0
LK70
R22 100K
C13 10NF
C14 10NF
R31 100K
TP12
LK76
LK51 0R0
LK50 0R0
LK49 0R0
TP13
LK5 0R0
LK65
LK55
LK31 0R0
TP30
LK21 0R0
LK69
LK62
LK61
LK58
LK57
TP3
LK38 0R0
TP4
LK37 0R0
LK36 0R0
TP5
LK30 0R0
LK27 0R0
LK25 0R0
LK22 0R0
LK11 0R0
NOTES
ATE TEST POINT
WIRE LINK IN THE NET
ZERO OHM RESISTOR IN THE NET

CIRCUIT DIAGRAM OF DISPLAY BOARD



NOTES

N/F = NOT FITTED.

ALL 0805 CAPACITORS 5% 50V UNLESS OTHERWISE STATED.

ALL 0805 RESISTORS 5% 0.1W UNLESS OTHERWISE STATED.

ALL ELECTROLYTIC CAPACITORS 16V UNLESS OTHERWISE STATED.

= ZERO OHM RESISTOR IN THE NET.

= WIRE LINK IN THE NET.

= ATE TEST POINT.

① FOR SONY APPLICATION:-

IR1 IS A SBX 1810-11

J2 IS NOT FITTED

SONY IR INTERFACE PARTS ARE FITTED

6
5
4
3
2
1
D
C
B
A
VFD1
VAC/FLUORESCENT DISPLAY
11-MT-91GK ISSUE C
+12VUNREG
FP_FILAMENT
Q6 ZTX450
Q5 ZTX749
C14 100NF 25V 20/80%
C2 10UF
LK45
LK49
U1
MN15841BPCEM
(809-1584003)
RIBBON CABLE
SW5 ECWOJ-C24-BE0024
PL1 FE CONNECTOR 10 WAY SIDE ENTRY
RST
FP_CLK
FP/MAC_DAT
FP/MAC_INT
+5VMOD
+12VUNREG
① SONY IR INTERFACE
LED3 STANDBY NOT FITTED
IR1 SBX1910-52
X1 CST 4.00 MGWTF01
SW2 B3F6005 STANDBY
SW1 B3F6005 VOLUME
SW3 B3F6005 CHANNEL
SW4 B3F6005 SURROUND
LED2 LED CHANNEL
LED1 LED VOLUME
Q1 BC856B
Q2 BC856B
Q3 BC856B
Q4 BC856B
Q7 BC856B
Q8 BC856B
Q9 BC856B
Q10 BC856B
Q11 BC846
Q12 BC846
D1 BAR43
D2 BAR43
D3 BAR43
D4 BAR43
D6 BAS16
D7 BAS16
L1 100R 0W25 5%
C18 330UF 25V
C1 100UF 25V
C5 330UF 10V
C6 100NF 25V 20/80%
C19 220nF 25V 20/80%
C11 10UF 50V 20%
C10 100NF 50V 20/80%
C20 220nF 25V 20/80%
C21 220nF 25V 20/80%
C7 100NF 25V 20/80%
C12 100uF 25V 20%
C22 100NF 10%
R38 22R 1W
-21V
+5V